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Nuclear Science Abstracts

NEW NUCLEAR DATA
1954 CUMULATION

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NEW NUCLEAR DATA

1. Radioactivity, Levels, Abundances, Moments
2. Neutron Cross Sections
3. Ground State Q's
4. Mass Differences and Ratios

INTRODUCTION

In this issue Nuclear Science Abstracts presents its third annual cumulation of new nuclear data. The results collected here have been abstracted from journals which have become available from about October 1953 to October 1954. A list of the specific journals covered is given below. Earlier 1954 nuclear data summaries have been published in the quarterly numbers of Volume 8, 6B (March 31), 12B (June 30, semi-annual cumulation), and 18B (September 30). These summaries are all included in the present one. The quarterly lists will be continued in 1955.

The nuclear data presented here have been compiled by the Nuclear Data Group which is sponsored by the National Research Council and supported by the Atomic Energy Commission and the National Bureau of Standards.

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Nuclear Data Cards: As the current literature is surveyed, the new nuclear results are first printed on 3 by 5 in. cards which are collected into sets of 100 to 150 cards each month. Individuals, laboratories, or libraries may subscribe to the card sets directly by applying to the Publications Office, National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C. The price, based on actual mechanical costs, is currently \$20 per year domestic and \$30 per year foreign (air mail postage included for foreign but not for domestic subscriptions). As long as they are available complete back 1954 card sets may be purchased for \$15 domestic and \$18 foreign. These collected sets will be shipped in one lot by surface mail. The cards were not produced before 1954.

Previous Annual Cumulations: Cumulations of nuclear data were presented by Nuclear Science Abstracts in 1952 and 1953 in issues numbered Vol. 6, 24B and Vol. 7, 24B respectively. These cumulations, also prepared by the Nuclear Data Group, include data appearing in the periods July 1951—October 1952 and October 1952—October 1953 respectively. The literature coverage for the 1952 cumulation began exactly where the coverage for the Supplements to NBS Circular 499 left off. The cumulations are available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. for \$0.25 each. Send check or money order but not stamps.

Revision of NBS Circular 499: The Nuclear Data Group is now engaged in the revision of Circular 499, Nuclear Data. It is planned to issue the new edition in five sections. The first section to appear will cover elements with Z from 20 through 40 since compilations on lighter elements have recently appeared.

CONVENTIONS

All energies are given in Mev and all cross sections in barns unless otherwise stated in the tabular material.

Numerals in italics following a measured value are the error (as reported by the authors) in the last figures of the values. In cases where confusion seems possible, the conventional ± is used.

Magnetic moments are reported as before without diamagnetic correction but are now based on $\mu(H) = 2.79267$ and the substandards listed by H. Walchli, ORNL-1469.

In writing reactions in Table 1, Radioactivity, Levels, Abundances, Moments, superscripts to denote the A value of the target nucleus have been used only when the target material is monoisotopic or has been isotopically enriched. "B^{10}(d,p)," for example, means that the d,p reaction was observed in a sample enriched in B^{10} while "B(d,p)" means it was observed in natural B. This policy was followed previously for "heavy" but not for "light" nuclei. It was not practical to adhere to it in Table 3, Ground State Q's. In this table, enrichment is denoted by underlining the A superscript.

Even when enriched material is not used, the nucleus under which the information is listed is often fairly certain because of some large natural abundance or cross section, or because of the particular activity produced or energy released. In such cases the nucleus in question is put down without a following "?". When there is no indication as to the isotope involved, information is listed under the element in question.

When a method of production of a radioactive nucleus has been given, the lowest bombarding energy used by the experimenter is indicated; e.g. Ag(20-Mev p). If this energy has actually been determined to be the threshold, it is underlined, e.g. Sn(14-Mev p).

The large black dots on the decay schemes are used to indicate experimentally established coincidences. α, β, or γ rays entering a level and dotted at their arrowheads have been shown to be in coincidence with gamma rays leaving the same level and dotted at their origins. In case of a simple cascade, the dots of the incoming and outgoing rays are superimposed.

Electron capture, ϵ, is shown on decay schemes by long and short dashes. Dashes of equal length are used for doubtful radiations or levels.

For the light nuclei, energy levels in the compound nucleus are tabulated rather than the resonant energy of the bombarding particle. The binding energy of the bombarding particle in the compound nucleus is taken from the table of F. Ajzenberg, T. Lauritsen, Rev. Mod. Phys. 24, 321(1952) for Z < 11, or from P. M. Endt, J. C. Kluyver, Rev. Mod. Phys. 26, 95(1954) for Z from 11 to 20.

ABBREVIATIONS

a	absorption
$a\beta\gamma$	absorption of β's in coincidence with γ's
ace^-	absorption of conversion electrons
a coin	absorption of photoelectrons between counters in coincidence
α	total γ-ray conversion coefficient, N_e/N_γ
$\alpha_K, \alpha_L, \ldots$	γ-ray conversion coefficient for electrons ejected from the K, L, ... shell
$\alpha_0, \alpha_1, \ldots$	α to g.s., first excited state, ... of residual nucleus
b	coefficient in angular correlation function, $1 + b\cos^2\theta$
B	band spectra method
$Be\gamma n$	measurement by detection of photoneutrons from Be
B_n, B_p	binding energy of a neutron, proton to a nucleus
$\beta\gamma(\theta)$	angular correlation of β's and γ's in coincidence

calc	calculated from experimental work reported elsewhere
cc	cloud chamber
CcW	Cockcroft Walton accelerator
ce^-	conversion electrons
chem	chemical separation of product following reaction
Cpt	Compton electrons
d	(1) deuteron, (2) descendant of, (3) days, when used as superscript
d,p(θ)	angular distribution of protons with respect to deuteron beam
$D\gamma n$,$D\gamma p$	measurement by detection of photoneutrons or photoprotons from deuterium
$\bar{E}$	average energy
E_0	resonance energy
E_β,E_γ, ...	energy of β ray, energy of γ ray, ...
E_{dis}	disintegration energy
EA	electrostatic analyzer
E1,E2, ...	electric dipole, electric quadrupole, ...
e_A	Auger electron
el	elastic scattering
ϵ	electron capture
ϵ_K,ϵ_L	electron capture from K, L shell
f	fission, in abbreviations for methods of production or detection
F-K	Fermi-Kurie β energy distribution plot
$\gamma(\theta,T)$	numbers of γ's as function of angle and temperature
$\gamma\gamma$, $\beta\gamma$, $\alpha\gamma$, $n\gamma$	$\gamma\gamma$, $\beta\gamma$, $\alpha\gamma$, or $n\gamma$ coincidences. (0.123 γ) (0.246 γ, 0.325 γ) means 0.123 γ in coincidence with 0.246 γ and 0.325 γ
Γ	resonance half-width (the whole width at half-maximum)
G-M	Geiger-Müller counter
g.s.	ground state
I	(1) nuclear induction magnetic resonance method; (2) spin in units $h/2\pi$. + or − signs after spin values denote even or odd parity of state in question
ic	ionization chamber
IT	isomeric transition
J	quantum state of compound nucleus in a nuclear reaction. "I" is used to denote the spin of the target nucleus, final nucleus
K/L	α_K/α_L
l	angular momentum of particle absorbed into or picked up from nucleus
Lin	linear accelerator
M	molecular or atomic beam resonance method
M1,M2, ...	magnetic dipole, magnetic quadrupole ...
mb	millibarns
Mic	microwave method
mir	measurement by total reflection of neutron beam from mirror surface
ms	mass spectrometer
μ	(1) magnetic moment in units of nuclear magnetons, (2) micron, 10^{-4} cm
μs	microseconds
osc	pile oscillator method
p	(1) proton, (2) predecessor of
p res	proton resonance. Magnetic field standardized by means of proton resonance frequency
para	paramagnetic resonance method
parentheses	parentheses are put around values which are given for identification purposes
pc	proportional counter
pe^-	photoelectrons
ppl	photoplates or emulsions
primes	primes indicate inelastically scattered particles
q	electric quadrupole moment in units of barns
quad res	quadrupole resonance method
Q	reaction energy in Mev
s	(1) spectrometer method, (2) seconds, when used as superscript
s coh	coherent scattering
s pr	pair spectrometer
S	atomic spectra measurement
scin	scintillation counter
2-cryst scin s	2-crystal scintillation spectrometer
sl	lens spectrometer
sl ce^-	conversion electrons measured in lens spectrometer
st	strong
$s\pi$	180° spectrometer
$s\pi\sqrt{2}$	double focusing spectrometer
σ	cross section in barns
σ_0	cross section at resonance energy, E_0
σ_a	absorption cross section
σ_t	total cross section

t	(1) triton, H^3, (2) **total cross section** when used under σ in cross section list
T	(1) isotopic spin; (2) temperature
τ	half life in units indicated
τ_1, τ_2	half life of upper, lower state
$\tau_{\beta\beta}$, $\tau_{\epsilon\epsilon}$	half life for double β, double ϵ decay
th	thermal
VdG	Van de Graaff accelerator
w,vw	weak, very weak
%	% of disintegrations
†	relative numbers. When used in connection with γ rays, relative numbers of photons, not photons plus conversion electrons, are meant
+,−	even, odd parity when used in connection with level properties

Standard journal abbreviations are used.

LIST OF JOURNALS SURVEYED FOR NSA 8

Acta Phys. Acad. Sci. Hung. 3, #2(1953); 4, #1 (1954).
Acta Phys. Austriaca 7, #4(1953); 8, #1-4(1953).
Acta Phys. Polon. 12, #3-4(1953); 13, #1-2(1954).
Anales real soc. espan. fis.y quim 49, #9-12 (1953); 50, #1-8(1954).
Ann. Phys. 8, July-Dec. (1953); 9, Jan.-Aug. (1954).
Ann. Physik 13, (1953); 14, (1954).
Arkiv Fysik 6, #5-6(1953); 7, #1-6(1954); 8, #1 (1954).
Australian J. Phys. 6, #3-4(1953); 7, #1-2(1954).
Bull. Research Council Israel 2, #4(1953); 3, #1-4 (1954).
Can. J. Chem. 31, #10-12(1953); 32, #1-11(1954).
Can. J. Phys. 31, #7(1953); 32, #1-9(1954).
Compt. rend. 237, #14-25(1953); 238, #1-26; 239, #1-16(1954).
Czechoslov. J. Phys. 1, #3-4; 2, (1952); 3, (1953); 4, #1(1954).
Doklady Akad. Nauk SSSR 90, #6; 91-92(1953); 93-95, 96, #1(1954).
Experientia 9, #10-12(1953); 10, #1-10(1954).
Helv. Phys. Acta 26, #6-8(1953); 27, #1-4(1954).
Indian J. Phys. 27, #4-12(1953); 28, #1-6(1954).
Izvest. Acad. Nauk Ser. Fiz. SSSR 17, #1-6(1953).
J. Am. Chem. Soc. 75, #19-24(1953); 76, #1-21 (1954).
J. Chem. Phys. 21, #10-12(1953); 22, #1-10(1954).
J. de Chim. Phys. 50, #9-12(1953); 51, #1-8(1954).
J. Franklin Inst. 256, #4-6(1953); 257; 258, #1-2 (1954).
J. Phys. Chem. 57, #7-9(1953); 58, #1-10(1954).
J. phys. radium 14, #10-12(1953); 15, #1-10(1954).
J. Phys. Soc. Japan 8, #5-6(1953); 9, #1-3(1954).
J. Research Nat. Bur. Standards 51, #3-6(1953); 52; 53, #1-3(1954).
Kgl. Danske Videnskab. Selskab, Mat-fys. Medd. 28, #2-11(1954).
Nature 172, #4379-4391(1953); 173; 174, #4418-4436(1954).
Naturwiss. 40, #18-24(1953); 41, #1-18(1954).
Nuovo Cim. 10, #10-12(1953); 11; 12, #1(1954).
Phil. Mag. 44, #357-359(1953); 45, #360-369(1954).
Physica 19, #9-12(1953); 20, #1-8(1954).
Phys. Rev. 92, (1953); 93-95; 96, #1(1954).
Proc. Phys. Soc. 66A, #406-408(1953); 67A, #409-418(1954).
Proc. Roy. Soc. 220A, (1953); 221A, 225A (1954).
Zhur. Ekspt'l Teoret. Fiz. 23, #6(1952); 24 (1953).
Z. Naturf. 8a, #9-12(1953); 9a, #1-9(1954).
Z. Phys. 135, #5; 136 (1953); 137, 138 (1954).

1. RADIOACTIVITY, LEVELS, ABUNDANCES, MOMENTS

n^2
0 2
?

56^hNi^{66} not found by (n^2,p) when Cu exposed to possible n^2 from Bi(23-Mev p,n^2)

B.L.Cohen, T.H.Handley, Phys. Rev. 92,101, (1953).

H^2
1 1
stable

Capture γ H(n,γ) E_n= th scin
2.23
No other γ (E_γ = 0.02 to 3) (<5%)

B. Hamermesh, R.J.Culp, Phys. Rev. 92,211(1953).

H^3
1 2
12.4^y

β^- 0.0176 *4*
Neutrino mass (kev): <0.500 (Dirac)
< 0.250 (Majorana), < 0.150 (Fermi)

D.R.Hamilton, W.P.Alford, L.Gross, Phys. Rev. 92, 1521 (1953).

He^4
2 2
stable

σ graph $H^2(d,p)$ E_d = 0.013 to 0.113
pc
σ graph $H^2(d,n)$ E_d = 0.013 to 0.113

W.R.Arnold, J.A.Phillips, G.A.Sawyer, E.J.Stovall, Jr., J.L.Tuck, Phys. Rev. 93, 483 (1954); 88, 159A (1953).

Level $H^3(p,p)$ E_p = 1 to 2.55
$\sigma_s(\theta)$ for 20° to 150° c.m. can be best fitted by phase shifts implying ^1P resonance in He^4. Non-resonant fit also good.

H.E.Ennis, A.Hemmendinger, Phys. Rev. 95, 772 (1954).

He^5
2 3
$\sim 10^{-21s}$

Levels $H^3(He^3,p)$ E_{He^3} = 0.30
g.s. p group observed at E_p= 9.33 scin
No group to first excited level observed

C.D.Moak, Phys. Rev. 92,383(1953); 91,462A(1953).

Level Li(d,He^3) E_d = 14.5 s
g.s.

S.H.Levine, R.S.Bender, J.N.McGruer, W.F.Vogelsang, Phys. Rev. 95, 640A (1954).

Levels $Li^6(n,d)He^5$ E_n = 14 ppl
g.s. l_p= 1 Γ= 0.8 n,d(θ)
(~2.6)* l_p= 1?
*Deuterons with E_d = 1.7 to 3.1 below g.s. group. No deuteron peak ascribable to 2.6 level seen.

$Li^7(n,t)$ E_n = 14 ppl
g.s. n,t(θ)
(~2.6) observed ?

G.M.Frye, Jr., Phys. Rev. 93, 1086 (1954).

He^5
2 3
$\sim 10^{-21s}$

Levels Li(n,t) E_n = 14.1 ppl
g.s.
2.4 *6*

D.L.Allan, Nature 174, 267 (1954).

Levels He(n,n) E_n = 2.6, 4.5, 5.5, 6.5
n,$\alpha(\theta)$ results fitted by S and P phase shifts derived by Dodder, Gammel from He(p,p). Splitting of $p_{3/2}$, $p_{1/2}$ levels by several Mev implied.

J.D.Seagrave, Phys. Rev. 92, 1093A, 1222 (1953).

Levels He(n,n) E_n = 14.1 cc
n,$\alpha(\theta)$ results fitted by Dodder, Gammel phase shifts. ($D_{3/2}$ shift = hard sphere value, $D_{5/2}$ shift = 0).

J.R.Smith, Phys. Rev. 95, 730 (1954).

Levels He(n,n) E_n = 15.7 cc
n,$\alpha(\theta)$ fitted best by Dodder, Gammel S, P, $D_{3/2}$ phase shifts with $D_{5/2}$ shift smaller than hard sphere value. $d_{5/2}$ level in He^5 above 12.5 Mev implied.

M.H.Alston, A.V.Crewe, W.H.Evans, L.L.Green, J.C.Willmott, Proc. Phys. Soc. 67A, 657(1954).

Level $H^3(d,n)$ E_d = 0.007 to 0.12
16.64 pc
σ_{max} = 4.95 at E_d = 0.107

W.R.Arnold, J.A.Phillips, G.A.Sawyer, E.J. Stovall, Jr., J.L.Tuck, Phys. Rev. 93, 483 (1954); 88, 159A(1953).

He^6
2 4
0.83^s

Levels $Li^{(7)}(d,He^3)He^{(6)}$ E_d = 14.5 s
g.s. l_p = 1 d,$He^3(\theta)$
(1.71)

S.H.Levine, R.S.Bender, J.N.McGruer, W.F.Vogelsang, Phys. Rev. 95, 640A (1954).

Level Li(γ,p) E_γ = 17.6
1.6 *2* ppl
Collinearity of p and He^6 tracks suggests this level decays by γ emission

E.W.Titterton, T.A.Brinkley, Proc. Phys. Soc. 67A, 469 (1954).

He^7
2 5

$Li^7(n,p)$ E_n = 14
Reaction not observed, $\sigma \leq$ 5mb for $-1 > Q > -7$

G.M.Frye, Jr., Phys. Rev. 93, 1086 (1954).

Li^4
3 1

$He^3(p,p)$ $E_p = 1.0$ to 3.5

Data fitted by single S and P phase shifts

R.W.Lowen, Phys. Rev. 96, 824A(1954); K.F.Famularo, R.J.S.Brown, H.D.Holmgren, T.F.Stratton, Phys. Rev. 93, 928A (1954)..

Li^5
3 2

$H(\alpha,\alpha)$ $E_\alpha = 3.1$ to 5.3 ppl

No levels from 0.6 to 1.06 Mev above He + H

No maxima found in energy distribution of p's scattered forward by Po α's slowed down in scattering foil

C.Ruhla, J. phys. radium 15, 451 (1954).

$He^3(He^3,p)$ $E_{He^3} = 0.1$ to 0.8

g.s. p group observed at 90° with $E_p \sim 8.5$

No group to first excited level scin

W.M.Good, W.E.Kunz, C.D.Moak, Phys. Rev. 94, 87 (1954).

Levels $He(p,p)$ $E_p = 5.78$

$p,\alpha(\theta)$ phase shift analysis shows large splitting of $p_{3/2}, p_{1/2}$ levels $(\Delta E_\lambda \sim 6$-Mev) in agreement with Dodder and Gammel, Phys. Rev. 88, 520 (1952).

W.E.Kreger, W.Jentschke, P.G.Kruger, Phys.Rev. 93, 837 (1954).

$He(p,p)$ $E_p = 9.5$ ppl

Graph of $p,p(\theta)$ for $\theta = 25°$ to 175°

R.G.Freemantle, T.Grotdal, W.M.Gibson, R.McKeague, D.J.Prowse, J.Rotblat, Phil. Mag. 45, 1090 (1954).

σ graph $He^3(d,p)$ $E_d = 0.036$ to 0.093 pc

W.R.Arnold, J.A.Phillips, G.A.Sawyer, E.J.Stovall, Jr., J.L.Tuck, Phys. Rev. 93, 483 (1954); 88, 159A (1953).

Capture γ $He^3(d,\gamma)$ $E_d = 0.46$

16.6 *2* scin

$\sigma_{max} \sim 0.05$ mb for $E_d \sim 0.46$

N.M.Hintz, J.M.Blair, D.M.Van Patter, Phys. Rev. 93, 910, 924A(1954).

Level $He^3(d,\alpha)$ $E_d = 0.38$ to 0.56

(16.8) $J = 3/2+$

$\sigma_{max} = 0.94$ for $E_d \sim 0.43$

G.Freier, H.Holmgren, Phys. Rev. 93, 825(1954).

Li^6
3 3
stable

$|q|$ >0 Li^{6}Cl M

$q(Li^6)/q(Li^7)$ is positive

P. Kusch, Phys. Rev. 92, 268 (1953).

Li^6
3 3
stable

$|q(Li^6)/q(Li^7)| = 0.019$ $LiAl(SiO_3)_2$ quad res

H.G.Cranna, Can. J. Phys. 31, 1185 (1953).

Level $Li^6(n,d)Li^7$ $E_n = 14$ ppl

g.s $l_p = 1$ $n,d(\theta)$

G.M.Frye, Jr., Phys. Rev. 93, 1086 (1954).

Levels $Li^{(7)}(d,t)Li^{(6)}$ $E_d = 14.5$ s

g.s. $l_n = 1$ $d,t(\theta)$

(2.19) $l_n = 1$

S.H.Levine, R.S.Bender, J.N.McGruer, W.F.Vogelsang, Phys. Rev. 95, 640A (1954).

Levels $Li^{(7)}(p,d)Li^{(6)}$ $E_p = 18$

g.s. $l_n = 1$ $p,d(\theta)$

(2.19) $l_n = 1$

J.B.Reynolds, K.G.Standing, Phys. Rev. 95, 639A (1954).

$He(d,\gamma)$ $E_d = 1.06$

No 2.19 capture γ ($\sigma < 0.1$ mb) scin

R.M.Sinclair, Phys. Rev. 93, 1082 (1954).

Level $He(d,d)$ $E_d = 1.0$ to 2.0

2.187 $J = 3+$ $\Gamma = 0.035$

σ and $d,d(\theta)$

No level between 2.2 and 3.2

T.Lauritsen, T.Huus, Phys. Rev. 92, 1501(1953).

Levels $He(d,d)$ $E_d = 0.3$ to 4.6

	J	Γ
(2.187)	3+	0.035
4.53	2+ (3+)	
5.4 *5*	1+	

From phase shift analysis of scattering data

A.Galonsky, M.T.McEllistrem, Phys. Rev. 96, 824A (1954); A.Galonsky, R.Douglas, W.Haeberli, M.McEllistrem, H.T.Richards, Phys. Rev. 93, 928A (1954).

Level $Be^9(p,\alpha\gamma)$ $E_p = 2.72$

γ 3.57 sl Cpt, pe$^-$

M1 from internal e$^+$ spectrum

Doppler correction (26 kev) not subtracted

R.J.Mackin, Jr., Phys. Rev. 94, 648 (1954).

$He(d,d)$ $E_d = 13.7$, 19.0 ppl

$d,d(\theta)$ for $\theta = 30°$ to 160° shows 2 minima

R.C.Freemantle, T.Grotdal, W.M.Gibson, R.McKeague, D.J.Prowse, J.Rotblat, Phil. Mag. 45, 1090 (1954).

$Li^6(\gamma,d)$ $E_\gamma = 17.6$ and 14.8

No reaction observed ($\sigma \leq 2 \times 10^{-6}$) ppl

E.W.Titterton, T.A.Brinkley, Australian J. Phys. 7, 350 (1954).

Li^7
3 4
stable

Q negative ?
Calculation takes into account quadrupole moment induced in s electrons by nuclear Q

R.M.Sternheimer, H.M.Foley, Phys. Rev. 92, 1460(1953); R.A.Logan, R.E.Coté, P.Kusch, Phys. Rev. 86, 280 (1952).

Level $Li^{(7)}(p,d)Li^{(6)}$ $E_p = 18$
g.s. $l_n = 1$ See Li^6

J.B.Reynolds, K.G.Standing, Phys. Rev. 95,639A (1954).

Level $Li^{(7)}(d,He^3)He^{(6)}$ $E_d = 14.5$ s
g.s. $l_p = 1$ See He^6
$Li^{(7)}(d,t)Li^{(6)}$ $E_d = 14.5$ s
g.s. $l_n = 1$ See Li^6

S.H.Levine, R.S.Bender, J.N.McGruer, V.F.Vogelsang, Phys. Rev. 95, 640A (1954).

Levels Li(d,p) $E_d = 3.0$
g.s. $l_n = 1$ d,p(θ)
(0.478) $l_n = 1$

W.E.Nickell, Phys. Rev. 95, 426 (1954).

Levels $Li^6(d,p)$ $E_d = 8$
g.s. $l_n = 1$ d,p(θ)
(0.478) $l_n = 1$

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A,1032 (1953).

Levels B(n,α) E_n = th
6.52† g.s. ic
93.48† (0.478)
†Relative cross sections

J.A.DeJuren, H.Rosenwasser, Phys. Rev. 93,831 (1954); 92, 544A(1953).

Levels Li(d,d') $E_d = 14.5$ s
g.s.
0.478
4.61
Li(d,p)
g.s.
0.478
6.56

S.H.Levine, R.S.Bender, J.N.McGruer, W.F.Vogelsang, Phys. Rev. 95, 640A (1954).

Level Li($\alpha,\alpha'\gamma$) $E_\alpha = 3.0$
γ 0.478 scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954); 94, 748A, 1252(1954).

Level $Be^9(d,\alpha\gamma)$
(0.478) I = 1/2 $\alpha,\gamma(\theta)$

L.Cohen, S.S.Hanna, C.M.Class, Phys. Rev. 94, 419 (1954).

Li^7
3 4
stable

Levels $Li(n,n't)He^4$ $E_n = 14.1$ ppl
4.6
6 to 7
9.3 ?

D.L.Allan, Nature 174, 267 (1954).

Levels* $Li^7(\gamma,n)$ βtron
9.6 14.0
10.8 17.5
12.4
*Sharp breaks in n yield curve

J.Goldemberg, L.Katz, Phys. Rev. 95, 471(1954).

Levels Li(γ,p) scin.
15.0
15.4
From activation curve for 0.83^s He^6

B.L.Tucker, C.E.Gregg, Phys. Rev. 93,362A (1954).

Li^8
3 5
0.9^s

Li(d,p) scin
(12.5 β) (1.5 α) (θ) ~ isotropic contrary to previous report

S.S.Hanna, E.C.LaVier, C.M.Class, Phys. Rev. 95, 110 (1954).

$Be^9(d,He^3)$ E_d = 13 to 20
Li^8 detected by α's scin
Yield curve consistent with Q(calc) = −11.87

M.M.Winn, Proc. Phys. Soc. 67A, 946 (1954).

Level $Li^7(d,p)$ $E_d = 8$
8.3† g.s. $l_n = 1$ d,p(θ)
†mb/sterad at 0°

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A,1032 (1953).

Levels Li(d,p) $E_d = 14.5$ s
g.s.
1.0
2.28

S.H.Levine, R.S.Bender, J.N.McGruer, W.F.Vogelsang, Phys. Rev. 95, 640A (1954).

Li^9
3 6
0.17^s

τ 0.168^s C($\lesssim$270-Mev γ)

D.Reagan, Phys. Rev. 92, 651 (1953).

Be^7
4 3
53.6^d

Level $B^{10}(p,\alpha\gamma)$ $E_p = 1.52$
γ 0.432 scin
No other γ with $E_\gamma \leq 0.80$

R.B.Day, T.Huus, Phys. Rev. 95, 1003 (1954).

Be^8
4 4
~10^{-16}s

Level $Be^9(p,d)Be^8$ $E_p = 18$
g.s. $l_n = 1$ p,d(θ)

J.B.Reynolds, K.G.Standing, Phys. Rev. 95, 639A (1954).

Be^8
4 4
$\sim 10^{-16}$s

Level Be^9(d,t) E_d= 1.16
g.s. graph of d,t(θ) ppl

M.K.Jurić, B.S.Marsicanin, Bull. Inst. Nuclear Sci., Boris Kidrich 3, 139 (1953).

B^{10}(n,t) E_n = 14.1 scin
Reaction to g.s. not observed(< 0.3 mb/sterad)

F.L.Ribe, J.D.Seagrave, Phys. Rev. 94, 934 (1954).

Levels Li^7(d,n) E_d = 2
g.s. pc, scin
3
No n groups to ~5- or ~7.5-Mev levels
(< 10%, < 20% of g.s. group respectively)

C.C.Trail, C.H.Johnson, Phys. Rev. 95, 1363 (1954).

Levels B(p,α) E_p = 1.98, 2.61
g.s.
2.9
No other levels found below 7 Mev (<10% g.s.)

R.Malm, D.R.Inglis, Phys. Rev. 92,1326(1953).

Level 0.9^sLi^8, 0.7^sB^8 decay
2.9 I = 2* Γ = 1.2 ppl
*Or I = 4 if whole α spectrum (0 to 6-Mev) is used to fit single resonance theory

F.C.Gilbert, Phys. Rev. 93, 499 (1954).

Levels B(d,α) E_d = 1.0 ppl
2.9
4.9
7.2
Observed at 4 angles, ~ 15,000α's at each angle

P.Cüer, J.J.Jung, R.Bilwes, Compt. rend. 238, 1405 (1954).

Li(d,nγ) E_d = 0.65
4.9 level not found
γ's with E_γ = 4 to 6 not observed scin
~4.9γ previously reported from this reaction now attributed to C^{12}

R.M.Sinclair, Phys. Rev. 93, 1082 (1954).

B(γ,d) C(γ,α) E_γ = 17.6
4.9 level not found ppl
No three pronged stars with 4.9-Mev total energy deficit (from possible intermediate Be^8 4.9γ emitting state)

E.W.Titterton, Phys. Rev. 94, 206 (1954).

Level Li(d,n) E_d = 0.75
5.4 a pc
4.9 level not found

G.C.Reid, Proc. Phys. Soc. 67A, 466 (1954).

Be^8
4 4
$\sim 10^{-16}$s

Levels Li^7(p,γ) E_p = 0.45
1.8† (4.09) I = 2 α range
1.7† 5.31 I = 2 α,γ(θ)
1.0† 7.51 I = 0 or 2
†Transitions to levels per 100 γ's from 17.63 level

E.K.Inall, Phil. Mag. 45, 768 (1954);
E.K.Inall, A.J.Boyle, Phil. Mag. 44, 1081 (1953).

Levels B(p,α) E_p = 0.15 to 0.55
g.s. pc
6.8 ?*
*α's possibly due to this level observed

H.Glättli, E.Loepfe, P.Stoll, Helv. Phys. Acta 27, 184A (1954).

Level Li(p,γ) E_p = 0.35 to 0.55
6.8 pc
Non-resonant α group found (E_α ~3.4) comprising ~ 1% of α's with E_α > 3

H.Glättli, E.Loepfe, P.Stoll, H.Widmer, Helv. Phys. Acta 27, 182A (1954).

Levels He(α,α) E_α = 12.9 to 21.6
7.55 J = 0 Γ = 1.2
10.8 J = 4 Γ = 1.2
α,α(θ)

F.E.Steigert, M.B.Sampson, Phys. Rev. 92,660(1953).

Levels Li(d,n) E_d = 0.4 to 4.7

	Γ
16.06	0.6
16.72	0.19
17.65	< 0.02
17.8	0.1
18.19	0.17

"Threshold" n's detected

T.W.Bonner, C.F.Cook, Phys. Rev. 96, 122; 94, 807A (1954).

Level Li(p,γ) E_p = 0.44 scin
(17.63)
No (> 6γ) (> 2.6 γ) (< 1% of all γ transitions)
No 10-12 γ (< 10% of 17.6 γ)

E.B.Nelson, W.Lawrence, R.R.Carlson, Phys. Rev. 96, 823A (1954).

Level Li(p,γ) E_p = 0.45
γ (17.63) M1,E2 e^+e^-(θ)

S.Devons, G.Goldring, Proc. Phys. Soc. 67A, 413 (1954).

p, α(θ) Li(p,α) E_p = 0.61, 0.71, 0.80
Coefficients of angular distribution given

D.K.Cartwright, L.L.Green, J.C.Willmott, Phil. Mag. 44, 1307 (1953).

Be^8
4 4
$\sim 10^{-16}$s

Level Li(p,p') $E_p = 1.05$ to 1.24
18.13 s
p,p'(θ, E_p) shows interference between levels of opposite parity

F.Mozer, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 93, 829 (1954).

Level Li(p,γ) $E_p = 0.88$ to 1.24
18.13 scin
p, > 5-Mev $\gamma(\theta, E_p)$ shows interference between levels of opposite parity.

A.A.Kraus, Jr., Phys. Rev. 93, 1308(1954).

Levels Li(p,γ) $E_p = 0.5$ to 2.5
(18.13) $\Gamma = 0.15$ scin
~19 $\Gamma \sim 0.4$
Counter biased to exclude $E_\gamma < 10$

P.C.Price, Proc. Phys. Soc. 67A, 849(1954).

Level Li(p,n) $E_p = 1.9$ to 2.4
~18.9 (resonance near threshold)

H.W.Newson, J.H.Gibbons, Phys. Rev. 95, 640A (1954).

$Li^6(d,\alpha)$ $E_d = 0.06$ to 0.45
$Li^6(d,n)53.6^d Be$
No resonances n/α yield ~ constant

F.Hirst, I.Johnstone, M.J.Poole, Phil. Mag. 45, 762 (1954).

Be^9
4 5
stable

Q ~0.02 Mic

W.D.Knight, Phys. Rev. 92, 539A(1953).

Level $Be^9(p,d)Be^8$ $E_p = 18$
g.s. $l_n = 1$ See Be^8

J.B.Reynolds, K.G.Standing, Phys. Rev. 95, 639A (1954).

Levels* $Li^7(He^3,p)$ $E_{He^3} = 0.72$
g.s. 3.24 scin
1.87 4.89 broad
2.58
*If five particle groups, superimposed on background, consist of protons

W.E.Kunz, C.D.Moak, W.M.Good, Phys. Rev. 95, 640A (1954).

Levels $B^{10}(n,d)Be^9$ $E_n = 14.1$ scin
8† g.s. $l_p = 1$ n,d(θ)
5† (2.43) $l_p = 1$
No 1.5 level (< 0.4 †)
No other level below 5.5
†Peak cross section in mb/sterad

F.L.Ribe, J.D.Seagrave, Phys. Rev. 94, 934 (1954); 95, 649A (1954).

Be^9
4 5
stable

Level $B^{11}(d,\alpha)$ $E_d = 0.427$
2.431 6 s

R.B.Elliott, D.J.Livesey, Proc. Roy. Soc. 224A 129 (1954).

Levels $Be^9(e,e')$ $E_e = 190$
2.54* s
6.96*
*From preliminary calibration

J.A.McIntyre, B.Hahn, R.Hofstadter, Phys. Rev. 94, 1084 (1954).

$$\begin{array}{l} Be^9(\gamma,n)Be^8 \\ Be^9(\gamma,\alpha)He^5 \end{array} \quad E_\gamma = \begin{cases} 6.1\ (67\%) \\ 7.0\ (33\%) \end{cases}$$

σ(all neutrons) = 1.25 ± 0.12 mb Mn^{55}act
σ(α's with $E_\alpha > 0.4$) = 1.28 ± 0.25 mb pc
Results show disintegration proceeds < 20% through Be^8 g.s.
$\sigma[Be^9(\gamma,n)]/\sigma Be^9(\gamma,\alpha)] \sim 1.2$

J.H.Carver, E.Kondaiah, B.D.McDaniel, Phil. Mag. 45, 948 (1954).

Levels $Li(d,p)0.9^s Li^8$
17.30 $E_d = 0.7$ to 3.3
17.49
No 17.8 level

S.Bashkin, Phys. Rev. 95, 1012, 640A (1954).

Be^{10}
4 6
2.5×10^6y

Level $Be^9(d,p)$ $E_d = 1.16$
g.s. graph of d,p(θ) ppl

M.K.Jurić, B.S.Marsicanin, Bull. Inst. Nuclear Sci., Boris Kidrich 3, 139 (1953).

Level $Be^9(d,p)$ $E_d = 8$
g.s. $l_n = 1$ d,p(θ)

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A, 1032 (1953).

Level $Be^9(d,p\gamma)$ $E_d = 0.48$ pc, scin
(3.37) 2^+ suggested by p,$\gamma(\theta,\phi)$

A.G.Stanley, Phil. Mag. 45, 807 (1954).

Level $Be^9(d,p\gamma)$ $E_d = 0.84$
(3.37) $I \geq 2$ p,$\gamma(\theta)$

L.Cohen, S.S.Hanna, C.M.Class, Phys. Rev. 94, 419 (1954).

Levels $Be^9(d,p)$ $E_d = 5.4$ to 7.6
3.37 6.26 s
5.96 7.37
~6.18* 7.52

C.K.Bockelman, J.J.Jung, Phys. Rev. 94, 748A (1954); * verbal report.

B^8
5 3
0.7^s

B^8 and Li^8 decay to same levels of Be^8
~ 15% of decays go to Be^8 levels above 2.9
α range distribution in ppl
Be (375-Mev α)

F.C.Gilbert, Phys. Rev. 93, 499 (1954).

B^9
5 4

Levels $B^{(10)}(p,d)B^{(9)}$ $E_p = 18$
g.s. $l_p = 1$ p,d(θ)
2.4 $l_n = 1$

J.B.Reynolds, K.G.Standing, Phys. Rev. 95, 639A (1954).

Levels $Be^9(p,n)$
~1.4 ? broad
2.36 narrow
"Threshold" n's detected

J.B.Marion, C.F.Cook, T.W.Bonner, Phys. Rev. 94, 807A (1954).

B^{10}
5 5
stable

Level $B^{(11)}(p,d)B^{(10)}$ $E_p = 18$
g.s. $l_n = 1$ p,d(θ)
$B^{(10)}(p,d)B^{(9)}$
g.s. $l_n = 1$ See B^9

J.B.Reynolds. K.G.Standing, Phys. Rev. 95, 639A (1954).

Level $B^{10}(n,d)Be^9$ $E_n = 14.1$ scin
g.s. $l_p = 1$ n,d(θ)

F.L.Ribe, J.D.Seagrave, Phys. Rev. 94, 934 (1954); 95, 649A (1954).

Levels $Be^9(d,n)$ $E_d = 0.96$ ppl

		l_p	
	g.s.	1	d,n(θ)
weak	0.72	1	
	1.74	1	
	2.15	1	
	3.58	1	

Distributions show combination of stripping and compound nucleus formation

J.S.Pruitt, C.D.Swartz, S.S.Hanna, Phys. Rev. 92, 1456 (1953); 91, 463A (1953).

Levels $Be^9(d,n)$ $E_d = 0.75$
0.6 2.9 ? a pc
1.8 3.5
2.2

G.C.Reid, Proc. Phys. Soc. 67A, 466 (1954).

Level $Be^9(d,n)$ recoil
γ (0.72) $\tau = 7 \pm 2 \times 10^{-10 s}$

J.Thirion, V.L.Telegdi, Phys. Rev. 92,1253 (1953).

Level $B^{10}(p,p'\gamma)$ $E_p = 1.5$ to 2.6
γ 0.718 scin
No other γ observed

R.B.Day, T.Huus, Phys. Rev. 95, 1003 (1954).

B^{10}
5 5
stable

Levels $B^{10}(p,p')$ $E_p = 6.92$ 877
0.717 5
1.739 5
2.152 5
3.583 5
4.771 5
$B^{10}(d,d')$ $E_d = 7.6$
1.74 level not observed

C.K.Bockelman, C.P.Browne, W.W.Buechner, A.Sperduto, Phys. Rev. 92, 665 (1953); 90, 340A (1953)

Levels $Li(\alpha,\gamma)$ $E_\alpha = 0.4$ to 1.4
4.75
<2†* (5.11) $J = 2^-$ $T = 0$
100† 5.162 8 $J = 2^+$ $T = 1$

*No resonance observed
Excitation function used for spin assignments
Estimates of T admixtures given

G.A.Jones, D.H.Wilkinson, Phil. Mag. 45, 703 (1954).

Levels $Be^9(d,n)$ $E_d = 0.4$ to 4.7

	Γ
4.78	< 0.01
5.11	< 0.01
5.17	< 0.01
5.93	< 0.01
6.06	< 0.01
6.16	< 0.02
6.43	
6.57	~ 0.03

"Threshold" n's detected

T.W.Bonner, C.F.Cook, Phys. Rev. 96, 122; 94, 807A (1954).

$Be^9(d,n)$ $E_d = 0.66$
(0.72 γ) (2.86 γ, 1.43 γ, 0.41 γ)
(1.02 γ) (1.43 γ, 0.72 γ, 0.41 γ)
(1.43 γ) (2.15 γ, 1.43 γ, 0.41 γ)
$\gamma\gamma(\theta)$ consistent with known spin assignments

S.M.Shafroth, S.S.Hanna, Phys. Rev. 95, 86, 641A (1954).

Capture γ's $Be^9(p,\gamma)$ scin
6.87 level $E_p = 0.315$ $J = 1$

0.72	100†	5.1
1.03	40†	6.0
1.43	15†	6.7
45†	4.7	

(1.03 γ) (0.72 γ)(θ) I = 0, 1, 3*

R.R.Carlson, E.B.Nelson, Phys. Rev. 95, 641A (1954); *verbal report.

Levels $Be^9(p,\gamma)$ $E_p = 0.90$ to 1.14
(7.48) $J = 2^-$ p,γ(θ)
(7.56) $J = 0^+$ p,γ(θ)

E.B.Paul, H.E.Gove, Proc. Roy. Soc. Canada, 47, 145A (1953).

B^{10}
5 5
stable

γ — $Be^9(p,\gamma)$ $E_p = 1.0$
(7.48) E1 + (E3 or M2) $e^+e^-(\theta)$

S.Devons, G.Goldring, Proc. Phys. Soc. 67A, 413 (1954).

Capture γ's $Be^9(p,\gamma)$ scin

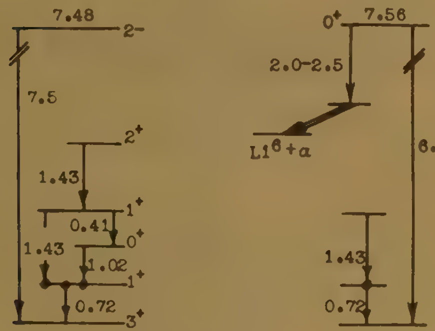
7.48 level $E_p = 0.993$ $\Gamma = 0.088$

0.26†	0.41	~0.3†	1.43
2.3 †	0.72	18.9†	7.5
0.6 †	1.02		

7.56 level $E_p = 1.085$ $\Gamma \sim 0.004$

≤0.008†	(0.41)	~0.06†	1.43
1.1 †	0.72	~0.15†	2.0-2.5
≤0.04 †	(1.02)	1.0 †	6.9

†Thick target γ yield per 10^9 protons



Stable B^{10}

W.F.Hornyak, T.Coor, Phys. Rev. 92,675(1953); 91, 463A(1953).

B^{10}
5 5
stable

Level $Be^9(p,\alpha\gamma)$ $E_p = 1.2$ to 2.7
(8.89) T = 1* $\Gamma = 0.041$ s

*Resonant for α's to 3.57 Li^6 level but not for α's to g.s. or 2.19 level

R.Malm, D.R.Inglis, Phys. Rev. 95, 993,641A (1954).

B^{10}
5 5
stable

Level $Be^9(p,\alpha\gamma)$ $E_p = 2.56$
(8.89) $J = 2^+$, T = 1

Spin assignments deduced from σ

R.J.Mackin, Jr., Phys. Rev. 94, 648 (1954).

B^{11}
5 6
stable

Q +0.0355 *2* M

G.Wessel, Phys. Rev. 92, 1581 (1953).

Level $B^{10}(d,p)$ $E_d = 1.43$ pc
g.s. $l_n = 1$ $d,p(\theta)$

W.H.Burke, J.R.Risser, G.C.Phillips, Phys. Rev. 93, 188 (1954).

Level $B^{(11)}(p,d)B^{(10)}$ $E_p = 18$
g.s. $l_n = 1$ $p,d(\theta)$

J.B.Reynolds, K.G.Standing, Phys. Rev. 95, 639A (1954).

B^{11}
5 6
stable

Levels $B^{10}(d,p)$ $E_d = 3.03$ ppl
g.s. $l_n = 1$ $d,p(\theta)$

$d,p(\theta)$ for g.s. and first 3 levels shows large compound nucleus contribution

W.W.Pratt, Phys. Rev. 93, 816 (1954).

Level $B(d,p)$ $E_d = 8$
g.s. $l_n = 1$ $d,p(\theta)$

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A, 1032 (1953).

Levels $B^{10}(d,p)$ $E_d = 8$ scin

		l_n	
10†	g.s.	1	$d,p(\theta)$
2†	2.14	1 ?	
6†	4.46	1	
2†	5.03	1	
35†	~6.8	1	
126†	~9.0	0,1 ?	

†Rel. numbers of protons at maxima

N.T.S.Evans, W.C.Parkinson, Proc. Phys. Soc. 67A, 684 (1954).

Levels $B^{10}(d,p)$ $E_d = 8.06$ sm

9†	7.99 *1*	$\Gamma < 0.010$ for
9†	8.57 *1*	first 5 levels
58†	8.93 *1*	
100†	9.19 *1*	
	9.28 *1*	
~60†	10.32 *2*	$\Gamma = 0.054$

† Rel. numbers of protons at 90°

M.M.Elkind, Phys. Rev. 92,127(1953); 91,463A(1953)

Levels $Li(\alpha,>4.5\gamma)$ $E_\alpha = 0.5$ to 2.5
9.19 $\Gamma = 4$ kev
9.29 $\Gamma = 7$ kev

No capture resonances from $E_\alpha = 0.96$ to 2.5

Levels $Li(\alpha,\alpha'+0.478\ \gamma)$ $E_\alpha = 1.5$ to 3.5 scin

9.88	
10.24	10.39 ?
10.32 ?	10.62

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 94, 1252, 748A (1954).

Levels $Be^9(d,n)$ $Be^9(d,p)$ $E_d = 0.96$
~16.7 J = 3/2 + } ? $d,n(\theta)$
~16.7 J = 5/2 − } $d,p(\theta)$

Strong cos θ terms superimposed on stripping patterns consistent with above spins

J.S.Pruitt, C.D.Swartz, S.S.Hanna, Phys. Rev. 92, 1456 (1953); 91, 463A (1953).

B^{12}
5 7
0.03^{s}

Levels $B^{11}(d,p)$ $E_d = 8.06$ sm

100†	g.s.	$\Gamma < 0.010$ for
78†	0.95 *1*	all levels
285†	1.67 *1*	
69†	2.62 *1*	
4†	2.72 *1*	
186†	3.38 *1*	

†Rel. numbers of protons at 90°

M.M.Elkind, Phys. Rev. 92,127(1953); 91,463A(1953)

B^{12}
5 7
0.03^{s}

Levels B(d,p) E_d = 8 d,p(θ)

		l_n
7††	g.s.	1
11†	(0.95)	1
54†	(1.67)	0
25†	(3.38)	1
1††	(3.76)	1?
29†	(4.53)	2

†mb/sterad at 0° ††mb/sterad at 15°,35° resp.

J.R.Holt, T.N. Marsham, Proc. Phys. Soc. 66A 1032(1953).

Levels B(d,p) E_d = 4.15 s
0.940
1.664

L.M.Khromchenko, Doklady Akad. Nauk SSSR 94, 1037 (1954).

B^{13}
5 8
?

τ < 5 x $10^{-4 s}$ or > 0.5^{h}
No activity attributable to this nucleus found when various low and middle Z targets irradiated by 340-Mev p, 190-Mev d

E.L.Hubbard, L.Ruby, W.F.Stubbins, Phys. Rev. 92, 1494 (1953).

C^{10}
6 4
19^{s}

Levels B^{10}(p,n) E_p = 17.2 ppl
g.s.
3.34 *20*
> 5 partly resolved
σ(3.34 level) > σ(g.s.)
p,n(θ) similar for 3.34 level and g.s.

F.Ajzenberg, W.Franzen, Phys. Rev. 95, 1531; 641A (1954).

C^{11}
6 5
20.4^{m}

β^{+} 0.968 *8* B(1.77-Mev d); sl

C.Wong, Phys. Rev. 95, 765 (1954).

B^{10}(d,n) E_d = 0.7 to 1.4
d,n(θ) shows l_p = 1 but neutron energies not determined long counter

W.H.Burke, J.R.Risser, G.C.Phillips, Phys. Rev. 93, 188 (1954).

Resonances B^{10}(p,γ) E_p = 0.5 to 1.7
0.78 wide
0.95?
1.33?

R.W.Krone, L.W.Seagondollar, Phys. Rev. 92, 935 (1953).

Levels B^{10}(p, ~9.7 γ) E_p = 0.5 to 2.5
9.8
10.9 ?
No resonances at E_p = 0.78, 0.95, 1.33

Level B^{10}(p,α+0.432 γ)
10.08 scin

R.B.Day, T.Huus, Phys. Rev. 95, 1003 (1954).

C^{12}
6 6
stable

B^{11}(d,n) E_d = 0.7 to 1.6
d,n(θ) shows l_p = 1 but neutron energies not determined long counter

W.H.Burke, J.R.Risser, G.C.Phillips, Phys. Rev. 93, 188 (1954).

Levels Be^{9}(α,nγ) E_α = 5.3 scin
94† g.s.
6† 4.4
†From measured rates and efficiencies assuming above are only levels involved

D.E.Diller, M.F.Crouch, Phys. Rev. 93, 362A (1954).

Level Be^{9}(α,nγ) E_α = 1.9
γ 4.425* *20* sl Cpt
E2 e^{+} spectrum
*Value after correction for Doppler shift which implies τ < 3x$10^{-13 s}$

W.R.Mills, R.J.Mackin, Phys. Rev. 95, 1206 (1954).

Level N(d,$\alpha\gamma$) E_d = 0.63 pc, scin
(4.43) I = 2^{+} α,γ(θ,ϕ)

A.G.Stanley, Phil. Mag. 45, 807 (1954).

γ's Be^{9}(α,nγ) E_α = 5.3
(4.43) E2, M1 $e^{+}e^{-}$(θ) cc
~7 0→0(7 pairs observed)

G.Harries, Proc. Phys. Soc. 67A, 153(1954).

Levels N(d,α) E_d = 0.62
100† (4.43)
6† 7.68 *3* Γ < 0.025 sm/2
No other level below 9.2 Mev (< 1†)

D.N.F.Dunbar, R.E.Pixley, W.A.Wenzel, W.Whaling, Phys. Rev. 92, 649,1095A(1953).

Levels C(α,α'γ) E_α = 22
(4.43) α', C recoil
7.7 α', no C recoil*
12.7 α'
*Probability of decay to Be^{8} + α > 80%
Broad α group at small angles may be from overlapping C^{12} states from 9 to 11.7 Mev

D.W.Miller, V.K.Rasmussen, M.B.Sampson, Phys. Rev. 95, 649A (1954).

Level Be^{9}(α,nγ) E_α = 5.3
(7.5) (3.1 γ)(4.43 γ) scin
Principal mode of decay is by cascade γ's

R.G.Uebergang, Australian J. Phys. 7,279(1954).

$C^{12}_{6\ 6}$
stable

Level $C(p,p'\gamma)$ E_p = 30 to 340
γ 15.2 T = 1 ? s pr

C.Waddell, H.Shaw, D.Cohen, B.J.Moyer, Phys. Rev. 96, 859A; 95, 664A (1954).

Levels $B(p,\gamma)$ E_p = 0.175 to 0.680
(16.10)* J = 2+ p,$\gamma(\theta)$
(16.57)** J = 2+
(17.22)*** J = 1-
*16- as well as 12-Mev γ resonant (not due to pile-up)
**16-Mev γ not observed but σ small
***Not studied. Spin from interference terms

P.J.Grant, F.C.Flack, J.G.Rutherglen, W.M.Deuchars, Proc. Phys. Soc. 67A, 751(1954).

Level $B(p,\alpha)$ E_p = 0.15 to 0.55
(16.10) J = 2+* p,$\alpha(\theta)$
*Interference from 1- level present
α's to Be^8 g.s. and possible Be^8 level at 6.8 observed for E_p = 0.55

H.Glättli, E.Loepfe, P.Stoll, Helv. Phys. Acta 27, 184A (1954).

Level $B(p,\gamma)$ E_p = 0.163
16.10
p, (16-Mev γ)(θ) shows interference term

D.S.Craig, W.G.Cross, R.G.Jarvis, Phys. Rev. 96, 825A (1954).

Levels $B(p,\gamma)$ E_p = 0.6 to 2.0
p, (12-Mev γ)(θ), p(16-Mev γ)(θ) obtained for five proton energies scin

N.H.Givin, G.K.Farney, T.M.Hahn, B.D.Kern, Phys. Rev. 95, 641A, 302A (1954).

$C(\gamma,\alpha)Be^8$ E_γ = 17.6 ppl
$C(\gamma,3\alpha)$
α energy distribution from 109 stars suggests both reactions take place

R.Chastel, J. Phys. radium 15, 240 (1954).

$B^{10}(d,n)$ E_d = 0.2 to 2.0
No resonances observed long counter

Resonances $B^{10}(d,p)$; $B^{10}(d,p\gamma)$
~1.0 ? pc
~1.5 ?

W.H.Burke, J.R.Risser, G.C.Phillips, Phys. Rev. 93, 188 (1954).

Levels* $C(\gamma,n))20.4^m C^{11}$ βtron
19.3 20.5 21.6
19.8 20.7 22.4
20.1 21.1 22.8
*Sharp breaks in activation curve

L.Katz, R.N.H.Haslam, R.J.Horsley, A.G.W.Cameron, R.Montalbetti, Phys. Rev. 95, 464 (1954).

$C^{12}_{6\ 6}$
stable

Levels* $C(\gamma,n)$ βtron
20.1 20.8 21.6
20.5 21.2 22.4
*Sharp breaks in n yield curve

J.Goldemberg, L.Katz, Phys. Rev. 95, 471 (1954).

$C^{13}_{6\ 7}$
stable

Level $C^{(12)}(d,p)$ E_d = 3.29
g.s. l_n = 1 d,p(θ)
Maximum where expected for l_n = 1 but fit not good at other angles
$C^{13}(d,t)$ E_d = 3.29,2.19
g.s. l_n = 1 d,t(θ)
Fit to theoretical curve fairly good

H.D.Holmgren, J.M.Blair, B.E.Simmons, T.F.Stratton, R.V.Stuart, Phys. Rev. 95,1544 (1954).

$B(\alpha,p)$ E_α = 5.3
No 0.7 level $\alpha p\gamma$

J.Thirion, Ann. Phys. 8, 489 (1953).

Levels $B^{10}(\alpha,p)$ E_α = 1 to 2 s
α,p(θ)

	I
g.s.	$1/2^-$
3.13	$1/2^+$
3.72	$3/2^-$
3.86	$5/2^+$

No 0.7 level (< 7% of g.s. protons)
0.21 γ observed, interpreted as 30% branch from 3.9 to 3.7 level
Yield proton groups given for 7 α energies

E.S.Shire, J.R.Wormald, G.Lindsay-Jones, A.Lundén, A.G.Stanley, Phil. Mag. 44, 1197(1953).

Levels $B^{10}(\alpha,p\gamma)$
(3.68) I = 3/2-* p$\gamma(\theta)$
(3.89) I = 5/2+
E_α = 1.31, 1.51, 1.64, 1.83
*0.21γ (from 3.89 to 3.68 level) is E1 p$\gamma(\theta)$

A.G.Stanley, Phil. Mag. 45, 430 (1954).

γ $C(d,p\gamma)$ E_d = 2.4
0.168 sl pe^-
45† (3.08) sl Cpt
5† 3.67
4† 3.83

R.J.Mackin, Jr., Phys. Rev. 92, 529A(1953).

Levels $C(d,p)$ E_d = 4.4 s
3.107
3.699
3.869
Errors not given

L.M.Khromchenko, Doklady Akad. Nauk SSSR 93, 451 (1953).

C^{13}
6 7
stable

Levels $B^{10}(\alpha,p)$ $E_\alpha = 4.8, 5.8$
3.09 s
3.68
3.8
No 0.70 level (p yield < 1% of g.s. group)*
No 4.6 level (p yield < 1% of 3.85 level group)*

W.J.Fader, A.Sperduto, Phys. Rev. 94, 748A (1954); * verbal report.

Levels C(d,p) d,p(θ)

σ*		l_n	σ*		l_n
0.12	3.71	1	0.14	6.91	0 or 1
0.20	3.88	2	0.08	7.23	0 or 1
0.08	4.75	0	0.08	7.39	0 or 1
0.08	5.03	0	0.13	7.58	0
0.06	5.22	0	0.12	7.75	0 or 1
0.05	5.45	0	0.13	7.88	2
0.05	5.78		0.13	8.02	1
0.12	6.21	0	0.20	8.16	0 or 1
0.11	6.36	0	0.25	8.34	
0.13	6.63	0	0.24	8.53	

*Total cross section in barns

J.Catalá, F.Senent, Anales real soc. españ fís. y quím. 50A, 55 (1954).

Level C(n,n) $E_n = 2.08$, scin
(6.87) $J = 3/2^+, 5/2^+$ n,n(θ)

R.Ricamo, Nuovo Cim. 10, 1607 (1953).

Levels $Be^9(\alpha,n)$; $Be^9(\alpha,n\gamma)$ $E_\alpha = 0$ to ~2
11.02
11.08
12.0

W.E.Bennett, P.A.Roys, B.J.Toppel, Phys. Rev. 93, 924A (1954).

Levels $Be^9(\alpha,n)$ $E_\alpha = 1.0$ to 3.5
long counter
11.98
12.21
12.44
13.01

R.E.Trumble, Jr., Phys. Rev. 94, 748A (1954).

$B^{11}(d,n)$ $E_d = 0.2$ to 2.0
No resonances observed long counter

W.H.Burke, J.R.Risser, G.C.Phillips, Phys. Rev. 93, 188 (1954).

C^{14}
6 8
~5600ʸ

τ 5900ʸ 250 extrapolation ic

R.S.Caswell, J.M.Brabant, A.Schwebel, J. Research Nat. Bur. Standards 53, 27 (1954).

Level $C^{13}(d,p)$ $E_d = 0.28$ to 0.64
g.s. $l_n = 1$ d,p(θ)
Reaction proceeds mainly by stripping

B Koudijs, F.P.G.Valckx, P.M.Endt, Physica 19, 1133 (1953).

C^{14}
6 8
~5600ʸ

$C^{13}(d,p\gamma)$ $E_d = 1.9$
γ 6.12 sl Cpt
6.73
Values without Doppler corrections
No additional γ's at $E_d = 2.6$

R.J.Mackin, Jr., W.B.Mims, W.R.Mills, Phys. Rev. 93, 950A (1954).

$C^{13}(d)$ $E_d = 4.0$
γ s 6.14 w 7.11* s pr
w 6.48* w 7.37*
s 6.72*
*Might be in N^{14}

R.D.Bent, T.W.Bonner, R.F.Sippel, Phys. Rev. 95, 649A (1954).

C^{15}
6 9
2.4ˢ

τ 2.4ˢ C^{14} (2-Mev d)
γ ~5.3 scin
Several weak γ's with $E_\gamma > 5.3$

K.R.Spearman, E.L.Hudspeth, I.L.Morgan, Phys. Rev. 94, 806A (1954).

Level $C^{14}(d,p)$
g.s. I = 5/2 ? from σ curve

J.A.Rickard, E.L.Hudspeth, Phys. Rev. 94, 806A (1954).

N^{13}
7 6
10.1ᵐ

Levels $N^{(14)}(p,d)N^{(13)}$ $E_p = 18.7$ scin
g.s. $l_n = 1$ p,d(θ)
d group to N^{13} 2.37 level not found
(< 4%, 15% of g.s. group if $l_n = 0, 2$)

K.G.Standing, Phys. Rev. 94, 731 (1954).

Level C(p,p) $E_p = 0.3$ to 0.6
2.370 Γ = 0.032 p,p(θ)

E.A.Milne, Phys. Rev. 93, 762 (1954).

Levels C(p,γ) $E_p = 1$ to 3 scin
(2.37)
Capture γ to 2.37 level observed as $f(E_p)$
2.37 level decays mainly to $C^{12} + p$
(3.511) $\Gamma_\gamma(1.14\gamma) = 0.04$ev
$(\Gamma_\gamma(3.51\gamma) = 0.7$ev)
γ(E,θ) near this resonance explained as due to interference between non-res. capture γ and res. radiation

H.H.Woodbury, A.V.Tollestrup, R.B.Day, Phys. Rev. 93, 1311 (1954).

N^{13}
7 6
10.1^m

Levels C(p,p) E$_p$ = 2 to 7
a

$\sim$4.9	
$\sim$6.4	

C(p,p'+4.40 γ) E$_p$ = 2 to 7
a, scin

$\sim$7*	6.90
$\sim$3*	7.40

*mb/sterad at 105°

D.Maeder, M.Martin, R.Müller, H.Schneider, Helv. Phys. Acta 27, 166A (1954); M.Martin, H.Schneider, M.Sempert, Helv. Phys. Acta 26, 595A (1953).

N^{14}
7 7
stable

Level N$^{(14)}$(p,d)N$^{(13)}$ E$_p$ = 18.7 scin
g.s. $l_n = 1$ p,d(θ)

K.G.Standing, Phys. Rev. 94, 731 (1954).

Levels O(d,α) E$_d$ = 19 ppl

2.6†	g.s.
<0.1†	(2.31)

†Total σ in mb

R.G.Freemantle, W.M.Gibson, D.J.Prowse, J.Rotblat, Phys. Rev. 92, 1268(1953).

Levels N(p,p') E$_p$ = 6.92 sw

2.313	*5*
3.945	*6*
4.91	*1*
5.10	*1*

N(d,d') E$_d$ = 6.98
2.31 level not observed

C.K.Bockelman, C.P.Browne, W.W.Buechner, A.Sperduto Phys. Rev. 92,665(1953); 90,340A(1953).

C^{13}(d,nγ) E$_d$ = 1.4, 1.9
γ w sl Cpt

3.91	
4.93	
5.13	
5.73	
6.45*	

No 6.82γ, (<14% of 5.73γ at E$_d$ = 1.42)
No additional γ's at E$_d$ = 2.6
*Not observed at E$_d$ = 1.4
Values without Doppler correction

R.J.Mackin, Jr., W.B.Mims, W.R.Mills, Phys. Rev. 93, 950A(1954).

C^{13}(d) E$_d$ = 4.0
γ s pr

s	4.96	w	6.48*
s	5.12	s	6.72*
s	5.74	w	7.11*
		w	7.37*

*Might be in C^{14}

R.D.Bent, T.W.Bonner, R.F.Sippel, Phys. Rev. 95, 649A (1954).

N^{14}
7 7
stable

Levels C^{13}(p,p) E$_p$ = 0.45 to 1.60
p,p(θ)

	J
(8.06)	1−
(8.62)	0+
(8.70)	0−
8.90	3−?
8.98	1+?

E.A.Milne, Phys. Rev. 93, 762(1954); 92,1085A (1954).

Capture γ's C^{13}(p,γ) scin
8.06 level E$_p$ = 0.55 T = 1 > 98%

2.307	<0.7†	(5.70)
4.11	100†	8.06

A.B.Clegg, D.H.Wilkinson, Phil. Mag. 44,1269, (1953).

γ's C^{13}(d,nγ) scin
5.69 level (3.38γ) (2.31γ)
5.81 level (0.73γ) (4.5-5.2γ)

Capture γ's C^{13}(p,γ) scin

8.06 level E$_p$ = 0.55 Γ = 0.033

7.3†	1.63	15†	4.0
7.3†	2.32	89†	8.0

8.62 level E$_p$ = 1.16 Γ = 0.006

39†	1.64	59†	4.7
66†	2.33	27†	6.25
20†	3.94	14†	8.6

8.70 level E$_p$ = 1.25 Γ = 0.5

≥ 90† 8.7

8.90 level E$_p$ = 1.47 Γ = 0.02

65†	0.731	100†	3.09
17†	2.32	48†	5.1
17†	2.8	35†	5.7

8.98 level E$_p$ = 1.55 Γ = 0.007

≥ 85† 9.0

9.17 level E$_p$ = 1.76 Γ = 0.0021

10†	2.73	90†	9.2
10†	6.5		

9.49 level E$_p$ = 2.10 Γ = 0.045

26†	2.32	100†	4.41
26†	2.78	74†	5.09

H.H.Woodbury, R.B.Day, A.V.Tollestrup, Phys. Rev. 92, 1199 (1953).

Levels B^{10}(α,pγ) E$_\alpha$ = 1.13 to 1.64
p, γ(θ)

12.42	J = 4−
12.69	J = 3−
12.78	J = 4+

Distribution of 0.2 and 3.7 + 3.9 C^{13} γ's consistent with above spins

A.G.Stanley, Phil. Mag. 45, 430 (1954).

N^{14}
7 7
stable

Levels $B^{10}(\alpha,p)$ $B^{10}(\alpha,d)$

	J	Γ
12.42	4^-	0.043
12.50		0.036
12.61		0.050
12.69	3^-	0.014*
12.78	4^+	0.014*
12.81	4^-	0.006
12.92	4^+	0.021

No capture γ's scin
Yield of p and d groups given for 7 α energies
*All partial Γ's also given $E_\alpha = 1$ to 2

E.S.Shire, J.R.Wormald, G.Kindsay-Jones, A.Lundén, A.G.Stanley, Phil. Mag. 44, 1197 (1953).

C(d,d) $E_d = 7.7$ ppl
Cross sections given for d,d(θ)

J.Catalá, F.Senent, J.Casanova, Anales real soc. españ fis. y quim. 50A, 145 (1954).

N^{15}
7 8
stable

Level N(d,p) $E_d = 0.4$, 0.5, 0.6
(g.s.) $l_n = 1$ d,p(θ)
Position of minimum agrees with stripping theory but high yield shows compound nucleus formation important

H.M.Jongerius, F.P.G.Valckx, P.M.Endt, Physica 20, 29 (1954).

$O^{18}(p,\alpha)$ $E_p = 0.4$ to 0.7
No γ scin

R.R.Roy, A.Lagasse, M.J.Decock, Phil. Mag. 44, 1189 (1953).

Levels N(d,pγ) $E_d = 0.63$ pc, scin
~5.3 I = 1/2±, 3/2± pγ(θ,ϕ)
d,p(θ) ~ isotropic

A.G.Stanley, Phil. Mag. 45, 807 (1954).

Levels $C^{14}(p,\gamma)$ $E_p = 0.3$ to 1.7
10.54* scin
10.70* J = 3/2− p,γ(θ)
10.80* J = 3/2−? p,γ(θ)
(11.30)** J = 1/2− p,n(θ) p,γ(θ)
*g.s. γ and ~5.3 γ observed **g.s. γ and n

G.A.Bartholomew, F.Brown, H.E.Gove, A.E.Litherland, E.B.Paul, Phys. Rev. 95, 595, 649A (1954).

Levels $C^{14}(p,\gamma)$ $E_p = 0.9$ to 2.2
$C^{14}(p,n)$ p,γ(θ) p,n(θ)

J		Γ_γ(kev)	Γ_n(kev)	Γ_p(kev)
1/2−	11.30	0.21	1.3	6.2
1/2+	11.44	2.2	34	9.4
1/2+	11.57	29	~5	~500

H.E.Gove, G.A.Bartholomew, E.B.Paul, A.E.Litherland, Phys. Rev. 96, 823A (1954).

N^{15}
7 8
stable

Capture γ's $C^{14}(p,\gamma)$ $E_p = 1$ to 2
~5 scin
Other γ's with $E_\gamma \leq 10$ Mev

K.R.Spearman, E.L.Hudspeth, I.L.Morgan, Phys. Rev. 94, 806A (1954).

Levels N(n,p) N(n,α)

N(n,p)		N(n,α)	
11.26	12.37	11.91	13.21
11.41	12.46	11.99	13.49
11.78	12.65	12.10	13.61
11.91	12.90	12.17	13.74
12.02	13.01	12.39	13.85
12.12		12.49	13.95
		12.63	14.01
		12.86	14.14
		12.96	

RaBe n ic

G. von Gierke, Z.Naturf. 8a, 567 (1953).

Levels B(α,n) $E_\alpha = 1.0$ to 3.5
long counter

12.12	13.19
12.52	13.38
12.92	

R.E.Trumble, Jr., Phys. Rev. 94, 748A (1954).

Levels N(n,n) $E_n = 2.6$ to 4.0
n,n(θ)

	J
13.22	7/2+
13.80	5/2+
14.02	3/2+
14.25	5/2+ (7/2+ ?)
14.43	5/2+
14.64	1/2+ (3/2+ ?)
14.92	5/2+ (7/2+ ?)

P.Huber, H.R.Striebel, Helv. Phys. Acta 27, 157A (1954); D.Speiser, M.Fierz, Helv. Phys. Acta 27, 159A (1954).

N^{16}
7 9
7.4^s

τ 7.38^s O(12-Mev n)

H.C.Martin, Phys. Rev. 93, 498 (1954).

Levels $O^{18}(d,\alpha)$ $E_d = 0.85$ s
g.s. ?
0.12 2
0.30 2
0.40 2
α energies measured at four angles

R.Pauli, Arkiv Fysik 8, 16A (1954).

Levels $N^{15}(d,p)$ $E_d = 2.0$ sm/2

	Q
0.11	+0.158
0.29	−0.022
0.39	−0.118

Assume g.s. p's obscured by N^{14}(d,p) group

J.Thirion, R.Cohen, W.Whaling, Phys. Rev. 96, 850A (1954).

N^{16}
7 9
7.4^{s}

Level $F^{19}(n,\alpha)$ $E_n = 4.87$ BF_3 pc
~0.3 Q = −1.77 ± 0.13
Agreement with masses found if transition to this level is assumed

D.B.James, W.Kubelka, S.A.Heiberg, Phys. Rev. 96, 856A (1954).

Level $C^{14}(d,p)$ $E_d = 0.6$ to 3.0
12.6 Γ~0.40

J.A.Rickard, E.L.Hudspeth, Phys. Rev. 94, 806A (1954).

O^{14}
8 6
72^{s}

τ 72.1^{s}
β^+ 1.835 8 F-K plot linear sl
ft = 3275 ± 75
No 4.1 β^+ (< 0.3% of 1.84 β^+, log ft > 7.3)

J.B.Gerhart, Phys. Rev. 95, 288 (1954).

β^+ 100† 1.83 N(p,n); $\beta\gamma$ scin
3†? (4.14)

J.R.Penning, F.H.Schmidt, Phys. Rev. 94, 779A (1954).

Levels N(p,n) $E_p = 17.3$ ppl

$$\left.\begin{matrix}6.2\\7.5\\9.3\end{matrix}\right\}\text{ wide or unresolved}$$

No levels 0 to 5.5 (n yield <25% of g.s. group)

F.Ajzenberg, W.Franzen, Phys. Rev. 94, 409 (1954).

O^{15}
8 7
2.0^{m}

Levels N(p,p) $E_p = 1.3$ to 1.9
8.78 J = 1/2+ p,p(θ)
8.95 J = 3/2−?
9.01

H.E.Gove, A.J.Ferguson, J.T.Sample, Phys. Rev. 93, 928A (1954).

O^{16}
8 8
stable

Level $F^{19}(p,\alpha\gamma)$ $E_p = 0.84$
γ (6.05) $0 \longrightarrow 0$ $e^+e^-(\theta)$ G-M

S.Devons, G.Goldring, G.R.Lindsey, Proc. Phys. Soc. 67A, 134 (1954).

Levels O(p,p') $E_p = 9.5$ ppl
(6.05) (6.9)
(6.13) (7.1)

W.E.Burcham, W.M.Gibson, A.Hossain, J.Rotblat, Phys. Rev. 92, 1266 (1953).

Level $F^{19}(p,\alpha\gamma)$
γ (6.13) E3 $e^+e^-(\theta)$

S.Devons, G.Goldring, Proc. Phys. Soc. 67A, 413 (1954).

O^{16}
8 8
stable

Levels O(n,n'γ) $E_n = 14.1$
γ 0.20* (6.13) scin
0.05* ~7.0
*Cross section in barns

L.C.Thompson, J.R.Risser, Phys. Rev. 94, 941 (1954).

Levels $F^{19}(p,\alpha\gamma)$ $E_p = 0.87$

	$\underline{I}$
(6.13)	3−
(6.9)	2^+
(7.1)	1^-

γ polarization studied by D(γ,p)

L.W.Fagg, S.S.Hanna, Phys. Rev. 92, 372 (1953); 88, 1205 (1952).

Levels C(α,α) $E_\alpha = 4$ to 6
~10.3 J = 4+ pc
11.1 narrow α,α(θ)
~11.5 J = 2+ wide

W.Haeberli, J.W.Bittner, R.D.Moffat, Phys. Rev. 94, 769A (1954).

Levels $N^{15}(p,\alpha)$ $E_p = 0.23$ to 0.96
(12.43) J = 0^+ $p,\alpha_0(\theta)$
(13.09) J = 1^-

A.V.Cohen, A.P.French, Phil. Mag. 44, 1259 (1953).

Levels $N^{15}(p,\gamma)$ $E_p = 0.3$ to 2.0
< 1† (12.43)
100† (13.09) J = 1 p,γ(θ)

$N^{15}(p,\alpha{+}4.4\,\gamma)$ p,γ(θ)
13.65 J = 1+ or 2− Γ~0.15

†Relative γ yield

A.A.Kraus, Jr., Phys. Rev. 94, 975 (1954).

Level $N^{15}(p,\gamma)$ $E_p = 1.05$
(13.09) $e^+,e^-(\theta)$
No decay through 6.06 e^+e^- emitting level
(< 1.3×10^{-3} of direct decays to g.s.)

G.Goldring, Proc. Phys. Soc. 67A, 930 (1954).

Levels* $O(\gamma,n)2.0^{m}O^{15}$ β tron

15.60	17.54
15.97	17.66
16.45	17.72
16.68	17.88
16.86	18.48
16.94	18.73
17.04	18.91
17.43	

*Sharp breaks in activation curve

B.M.Spicer, A.S.Penfold, J.Goldemberg, Phys. Rev. 95, 629A (1954).

O^{16}
8 8
stable

Levels* $O(\gamma,n)2.0^{m}O^{15}$ βtron
15.9 16.9 19.3
16.4 17.1 20.7
16.7 18.9 21.9
*Sharp breaks in activation curve

L.Katz, R.N.H.Haslam, R.J.Horsley, A.G.W.Cameron, R.Montalbetti, Phys. Rev. 95, 464 (1954).

Levels* $O(\gamma,n)$ βtron
19.1 20.7 21.9
*Sharp breaks in n yield curve

J.Goldemberg, L.Katz, Phys. Rev. 95,471(1954).

Level $O(\gamma,n)2.0^{m}O$ $E_\gamma = 17.6$ to 17.9
17.71 $\Gamma \sim 0.020$
γ's produced by $Li(p,\gamma)$

J.G.Campbell, Phys. Rev. 95, 1357 (1954).

Levels $N(d,\alpha\gamma)$ $E_d = 0.63$ pc
~21
$d,\alpha(\theta)$ shows interference term

A.G.Stanley, Phil. Mag. 45, 807 (1954).

Levels $N(d,\alpha)$ $E_d = 0.60, 0.73$ $d,\alpha(\theta)$
~21 J = 1-, 2+, 3- states found

D.Cartwright, L.L.Green, J.C.Willmott, Phil. Mag. 45, 742 (1954).

Levels $O(\gamma,\alpha)$ $E_\gamma \leq 31$ ppl
Small α yield at $E_\gamma \sim 24$ (where there is large n yield from E1 γ absorption) attributed to T selection rule

P.Erdös, J.Schmouker, P.Stoll, Helv. Phys. Acta 27, 186A (1954).

O^{17}
8 9
stable

Q -0.004 Mic
Calculated from data of Geschwind et al, Phys. Rev. 85, 474 (1952).

G.R.Bird, C.H.Townes, Phys. Rev. 94, 1203 (1954).

Levels $O(d,p)$ $E_d = 19$ ppl
36† g.s. $l_n = 2$ $d,p(\theta)$
23† (0.88) $l_n = 0$
†Total σ in mb

R.G.Freemantle, W.M.Gibson, D.J.Prowse, J.Rotblat, Phys. Rev. 92,1268(1953).

Level $O(d,p)$ $E_d = 1.66$ to 2.2 ppl
(0.88) $l_n = 0$ $d,p(\theta)$

A.Berthelot, R.Cohen, E.Cotton, H.Faraggi, T.Grjebine, A.Leveque, V.Naggiar, M.Roclawski-Conjeaud, D.Szteinsznaider, Compt. rend. 238, 1312 (1954).

O^{17}
8 9
stable

Level $O(d,p)$ $E_d = 3.01, 3.43$
(0.88) $l_n = 0$ $d,p(\theta)$

D.M.Van Patter, B.E.Simmons, T.F.Stratton, D.M.Zipoy, Phys. Rev. 96, 825A (1954).

Level $O(d,p)$ recoil
(0.88) $\tau = 2.5 \pm 1.0 \times 10^{-10}$s

J.Thirion, V.L.Telegdi, Phys. Rev. 92,1253(1953).

Level $N(\alpha,p)$ $E_\alpha = 5.30$ ppl
0.86

E.Hjalmar, H.Slätis, Arkiv Fysik 6,451(1953).

Level $Ne(n,\alpha)$
0.87 ic

F.C.Flack, J.B.Warren, Proc. Roy. Soc. Canada, 47, 131A(1953).

Levels $O(d,p)$ $E_d = 4.32$ s
0.893
3.005
3.853
Errors not given

L.M.Khromchenko, Doklady Akad. Nauk SSSR, 93, 451 (1953).

Levels $O(n,n)$ $E_n = 0.39$ to 1.4
4.56 J = 3/2 - $n,n(\theta)$
5.08 J = 3/2 + 0 recoil
5.39 J = 3/2 -

R.K.Adair, Phys. Rev. 92, 1491 (1953).

Levels $O(n,\alpha)$
6.55 7.28
6.79 7.43
6.96 7.63
7.11
$Li(d,n)$ ic

K.Kimura, R.Ishiwari, M.Sakisaka, I.Kumabe, S.Yamashita, K.Miyake, Bull. Inst. Research, Kyoto. Univ. 31,204(1953); Chem. Abstr. 47-10358g(1953).

Levels $O(n,\alpha)$
6.83 7.85 9.76 11.36
6.89 7.98? 10.07 11.49
6.99 8.23 10.25? 11.61?
7.11 8.62 10.39 11.84
7.35 8.84 10.57 12.03
7.48 9.09 10.85 12.25
7.63 9.34 11.07? 12.47
7.71 9.57? 11.17 12.73?
RaBe n ic

G. von Gierke, Z. Naturf. 8a, 567 (1953).

O^{17}
8 9
stable

Levels C(α,n) E_α = 0 to 2
7.158 *9* $\Gamma \sim$ 0.003 scin
7.372 *11*

G.A.Jones, D.H.Wilkinson, Proc. Phys. Soc. 66A, 1176 (1953).

Levels C^{13}(α,n) E_α = 1.0 to 3.5
long counter
8.21
8.34
8.45
8.66

R.E.Trumble, Jr., Phys. Rev. 94, 748A (1954).

O^{19}
8 11
29.4^s

Levels O^{18}(d,p) E_d = 2.18 s
0.100
1.469
No other levels below 2.4 observed in O^{19}

J.Thirion, R.Cohen, W.Whaling, Phys. Rev. 96, 850A (1954).

Level O^{18}(d,p) d,p(θ)
~1.6* l_n = 0 Q = 0.3± 0.3
*Assuming g.s. p's coincide with O^{16}(d,p) g.s. group

T.F.Stratton, K.F.Famularo, H.D.Holmgren, R.V.Stuart, Phys. Rev. 96, 825A (1954).

F^{17}
9 8
66^s

τ 66^S O(2.1-Mev d)
β^+ 1.748 *6* sl
No 0.87 β^+ (< 1% of 1.748 β^+)

C.Wong, Phys. Rev. 95,765(1954); 92,529A (1953).

τ 66^S O(13-Mev d)
β^+ 1.76 a
No γ ($E_\gamma/\beta <$ 0.1 Mev) a

L.Koester, Z.Naturf. 9a, 104 (1954).

No γ with $E_\gamma >$ 0.51 (< 1.5%) scin

J.B.Warren, K.A.Laurie, D.B.James, K.L.Erdman, Can. J. Phys. 32, 563 (1954).

Capture γ's O(p,γ) E_p = 0.8 to 2.1

		p,γ(θ)
st	0.49	isotropic
st	0.107 + 16/17 E_p	1 + 5 sin^2 θ
w	0.594 + 16/17 E_p	

0.873 γ observed only for $E_p >$ 1.8, attributed to O^{17}(p,p')

J.B.Warren, K.A.Laurie, D.B.James, K.L.Erdman, Can. J. Phys. 32, 563 (1954); Phys. Rev. 86, 857A (1954).

F^{17}
9 8
66^s

Levels O(p,p) E_p = 3 to 7

	J	Γ	
4.50	3/2−	0.40	p,p(θ)
4.60	3/2+	0.35	
5.15	1/2+	0.20	
6.65	1/2+	0.15	

3.86	5.90	$\Gamma <$ 0.025
5.05	6.15	
5.30	6.75	
5.50	6.90	
5.70	7.40	

M.Sempert, H.Schneider, H.Martin, Helv. Phys. Acta 27, 313 (1954).

F^{18}
9 9
1.87^h

Level F^{19}(p,d)F^{18} E_p = 18
g.s. l_n = 0 p,d(θ)

J.B.Reynolds, K.G.Standing, Phys. Rev. 95, 639A (1954).

Levels N(α,p) E_α = 1.5 to 3.5

		Γ	
0.3†	6.694	0.027	pc
5†	6.854	0.093	
	~7.1	~0.46	

$\alpha\alpha$ elastic resonances consistent with above levels
†Percent of elastic scattering

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 92,89(1953)

O(d,γ) E_d = 1.1
No capture γ's ($\sigma <$ 0.5mb) scin

R.M.Sinclair, Phys. Rev. 93, 1082 (1954).

Levels O(d,p_o) E_d = 2.3 to 3.9
9.89
10.21
10.42
10.58

D.M. Van Patter, B.E.Simmons, T.F.Stratton, D.M.Zipoy, Phys. Rev. 96, 825A (1954).

F^{19}
9 10
stable

Level F^{19}(p,d)F^{18} E_p= 18
g.s. l_n = 0 See F^{18}

J.B.Reynolds, K.G.Standing, Phys. Rev. 95, 639A (1954).

Levels F^{19}(p,p'γ) E_p= 0.3 to 1.5 s
0.1139 I = 1/2 p,p'(θ) p,γ(θ)
0.1996 I = 5/2+ p,p'(θ) p,γ(θ)
No 0.0857 γ (< 1% of 0.200 γ) scin
See also Ne^{20}

R.W.Peterson, C.A.Barnes, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 94, 1075 (1954); 94, 951A (1954).

F^{19}
9 10
stable

Levels $F^{19}(p,p'\gamma)$ $E_p = 1.4, 1.1$
(0.114) $\tau = 0.1 \times 10^{-8s}$ recoil
(0.200) $\tau = 8 \times 10^{-8s}$

J.Thirion, C.A.Barnes, C.C.Lauritsen, Phys. Rev. 94, 1076 (1954).

Levels $F^{19}(\alpha,\alpha'\gamma)$ $E_\alpha = 0.6$ to 2.8
(0.114) $I = 1/2-$*
(0.200) $I = 5/2+$*
*From agreement of observed τ_γ's and τ_γ's
calculated from σ's and these spins

R.Sherr, C.W.Li, R.F.Christy, Phys. Rev. 94, 1076 (1954).

Levels $F^{19}(\alpha,\alpha'\gamma)$ $E_\alpha = 1.1$ to 2.4
γ 0.113 scin
0.196
Yield (0.196 γ)>> yield (0.113 γ)
No 0.083 γ (< 2% of 0.196 γ)

H.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 351 (1954); 94, 748A, 1252 (1954).

Levels $F^{19}(\alpha,\alpha'\gamma)$ $E_\alpha = 1.20$
γ 0.35† 0.112 scin
1.4 † 0.195
†Thick target yield per 10^{10} α's

G.A.Jones, D.H.Wilkinson, Phil. Mag. 45, 230 (1954).

Levels $O^{18}(d,n)$ $E_d = 2$ ppl
0.2 3.85
0.9 4.5
1.4 4.8
1.6 5.2
2.2 5.5
2.75

R.L.Seale, Phys. Rev. 92, 389 (1953).

Levels* $F^{19}(\gamma,n)1.87^hF$ βtron
10.6 11.9
10.9 12.2
11.2 15.3
11.5
*Sharp breaks in activation curve

J.G.V.Taylor, L.B.Robinson, R.N.H.Haslam, Can. J. Phys. 32, 238 (1954).

Levels* $F^{19}(\gamma,n)$ βtron
11.0 11.9
11.5 15.3
*Sharp breaks in n yield curve

J.Goldemberg, L.Katz, Phys. Rev. 95, 471(1954).

F^{20}
9 11
12^s

β^- 100% 5.419 *13* F^{19}(2.3-Mev d) sl
F-K plot linear to 1 Mev
γ 1.627 sl pe^-
No 7.06 β (<0.03%)

C.Wong, Phys. Rev. 95, 761(1954); 92, 529A (1953).

Ne^{18}
10 8
1.6^s

τ 1.6^s F^{19}(24-Mev p)
β^+ 3.2 log ft = 2.9 s77

J.D.Gow, L.W.Alvarez, Phys. Rev. 94,365(1954).

Ne^{19}
10 9
18.5^s

τ 19^s *1* F^{19}(28-Mev d) G-M
406 mg/cm² used to cut out F^{17} and F^{18} β^+

M.E.Nahmias, J. phys. radium 15, 677 (1954).

β^+ branching to 0.1-0.2 F^{19} levels <~0.1%

W.P.Alford, D.R.Hamilton, Phys. Rev. 94, 779A (1954); verbal report.

Energy spectrum of Ne recoils at 180° from
β^+ consistent with S,T β interaction

W.P.Alford, D.R.Hamilton, Phys. Rev. 95, 1351 (1954).

Ne^{20}
10 10
stable

Level $Na^{23}(p,\alpha\gamma)$ $E_p = 0.7$ to 1.5
γ 1.629 scin

J.O.Newton, Phys. Rev. 96, 241 (1954).

$Ne(p,p'\gamma)$ $E_p = 1.35$ to 4.4
No 2.2γ scin

M.C.Cox, J.J.vanLoef, D.A.Lind, Phys. Rev. 93, 925A(1954).

Level $F^{19}(p,\alpha\gamma)$ $E_p = 0.224$
(13.08)
Level decays chiefly to O^{16} 6.13 level.
$\alpha\gamma(\theta)$ anisotropic. Decay to O^{16} g.s.
inhibited by factor of 2

E.B.Nelson, W.Lawrence, R.R.Carlson, Phys. Rev. 96, 825A (1954).

Levels $F^{19}(p,\alpha)$
13.44 $\Gamma_\gamma < 2$ ev* scin
13.70 $\Gamma_\gamma < 15$ ev*
*From intensity of Ne^{20} 12-Mev γ relative to
O^{16} 6- and 7-Mev γ's

D.H.Wilkinson, A.B.Clegg, Phil. Mag. 44, 1322 (1953).

Levels $F^{19}(p,p)$ $E_p = 0.55$ to 1.8
13.505 14.157 s
13.659 14.182
13.700 14.230
13.759 14.48
Marked anomalies in $p,p(\theta)$ found at above
levels corresponding to known γ resonances

T.S.Webb, F.B.Hagedorn, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 96, 851A (1954).

Ne^{20}
10 10
stable

Levels $F^{19}(p,p'+0.114\ \gamma)$ $p,p(\theta)$

J		J	
(13.505)	1+	(14.157)	2−
(13.759)	1+	(14.182)	2−
(13.907)	2−	14.230	1+

$F^{19}(p,p'+0.200\ \gamma)$

(13.700)	2−	(14.157)	2−
(13.907)	2−	(14.182)	2−

R.W.Peterson, C.A.Barnes, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 94, 1075 (1954); 94, 951A (1954).

Levels $F^{19}(p,12\text{-Mev}\ \gamma)$

	Γ (kev)	$E_p = 0.62$ to 1.65
13.505	7.5	scin
13.908	< 1.2	
14.128	4.0	
14.230	15.7	

R.M.Sinclair, Phys. Rev. 93, 1082 (1954).

Levels $F^{19}(p,\alpha\gamma)$
(13.759) J = 1+ p, 6.14$\gamma(\theta)$
(14.182) J = 2− p, 6.9γ + 7.1$\gamma(\theta)$
$(6.14\gamma)/(6.9\gamma+7.1\gamma) = 8.7$ at 90° $E_p = 1.381$

J.E.Sanders, Phil. Mag. 44, 1302 (1953).

Ne^{21}
10 11
stable

Level $Ne^{20}(d,p)$ $E_d = 0.877$
0.349 s

K.Ahnlund, Arkiv Fysik 7, 155 (1954).

Levels Ne(n,α)

8.13	9.39	10.81	12.38
8.27	9.48	11.02	12.64?
8.45	9.68	11.17	12.83
8.59?	9.86	11.30	12.98
8.71	10.33	11.49	13.10?
9.00	10.47	11.60	13.32?
9.10	10.60?	11.90	13.42
9.18			

RaBe n Ic

G. v. Gierke, Z.Naturf. 9A, 164 (1954).

Levels Ne(n,α)

9.85	10.85	11.27
10.08	10.90	11.38
10.32	11.04	11.44
10.48	11.12	11.49
10.72	11.20	11.60

Assuming $B_n(Ne^{20}) = 6.756$

F.C.Flack, J.B.Warren, Proc. Roy. Soc. Canada 47, 131A (1953).

Ne^{22}
10 12
stable

Ne(p,p'γ) $E_p = 1.35$ to 4.4
No 0.4γ scin

M.C.Cox, J.J.vanLoef, D.A.Lind, Phys. Rev. 93, 925A (1954).

Ne^{22}
10 12
stable

Level $F^{19}(\alpha,p\gamma)$ $E_\alpha = 1.3$ to 3.5
γ 1.28* scin
No 0.4 γ
*Not F^{19} 1.37 γ. Assignment from agreement with known level.

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 94, 1252 (1954).

Levels $F^{19}(\alpha,p\gamma)$ $E_\alpha = 7.6$

1.28 level

γ		1.28			pγ	scin

3.3 level

γ	75%	1.28			pγ	scin
	75%	2.1	25%	3.4		

4.9 level

γ	50%	1.28	~50%	4.9	pγ	scin
	50%	3.6				

No 1.5 γ (< 5%)

B.P.Foster, G.S.Stanford, L.L.Lee, Jr., Phys. Rev. 93, 1069 (1954); 94, 804A (1954).

Na^{21}
11 10
23^s

Levels Ne(p,p'+1.64 γ) $E_p = 1.35$ to 4.4

4.33	5.73	scin
4.44	5.84	
4.50	5.85	
5.05	6.11	
5.49	6.26	

M.C.Cox, J.J.vanLoef, D.A.Lind, Phys. Rev. 93, 925A (1954).

Na^{22}
11 11
2.6^y

ε 9.9 ± 0.6% βγ/γ
Theoretical value for allowed transition = 10.2

R.Sherr, R.H.Miller, Phys. Rev. 93, 1076 (1954); 92, 848A (1953).

ε 7 ± 2% βγ,γγ

W.F.Hornyak, T.Coor, Phys. Rev. 92, 675 (1953).

ε 9 ± 5% γγ/γ GM

R.Sehr, Z. Phys. 137, 523 (1954).

ε 11 ± 5% 0.511 γ/1.3 γ scin

D.Maeder, R.Müller, V.Wintersteiger, Helv. Phys. Acta 27, 3 (1954).

ε 11% 0.511 γ/1.3 γ scin

W.E.Kreger, C.S.Cook, Phys. Rev. 96, 854A (1954).

Level $F^{19}(\alpha,n\gamma)$ $E_\alpha = 3.1$ to 3.5
γ 0.592 τ < 0.01^s scin
Assignment from rise in n yield ~0.7 Mev above threshold

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 94, 1252 (1954).

Na^{23}
11 12
stable

q +0.10 S

P.L.Sagalyn, Phys. Rev. 94, 885 (1954).

Level $Na^{23}(p,p'\gamma)$ $E_p = 0.7$ to 1.5
γ 0.444 scin

J.O.Newton, Phys. Rev. 96, 241 (1954).

$Na^{23}(\alpha,\alpha'\gamma)$ $E_\alpha = 1.4$ to 3.5*
γ 0.446 scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 95, 629A (1954); *verbal report.

Levels $F^{19}(\alpha,\alpha'+0.114\ \gamma)$ scin
$E_\alpha = 1.0$ to 3.5

12.32	12.68	13.03
12.55	12.78	13.13
12.60	12.90	13.26

$F^{19}(\alpha,\alpha'+0.200\ \gamma)$

12.32	12.60	13.00
12.40	12.68	13.13
12.47	12.78	13.26
12.55	12.90	

$F^{19}(\alpha,p+1.28\ \gamma)$ $E_\alpha = 1.3$ to 3.5

11.73	12.40	
11.91	12.47	12.85
12.08	12.55	12.90
12.15	12.60	13.00
12.24	12.68	13.13
12.32	12.78	13.26

$F^{19}(\alpha,n+0.59\ \gamma)$
13.13 $E_\alpha = 3.1$ to 3.5
13.26

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 94, 748A, 1252 (1954).

Na^{24}
11 13
15.0^h

Levels $Na^{23}(d,p)$ $E_d = 3.0$

	l_n
g.s.	2
(0.472) (0.564)	0 and 2
(1.341)	0

P.Shapiro, Phys. Rev. 93, 290 (1954).

Levels $Na^{23}(d,p)$ $E_d = 10$ ppl

	l_n
g.s.	2
(0.472) (0.564)	0 and 2
(1.341)	0

Capture γ data indicate $l_n = 2$ for 0.472 level and $l_n = 0$ for 0.564 level

M.M.Bretscher, J.O.Alderman, A.Elwyn, F.B.Shull, Phys. Rev. 96, 103 (1954).

Na^{25}
11 14
62^s

τ 60^s Mg(n)
β^- ~50% 3.0 a$\beta\gamma$
~50% 3.7 a
γ 0.63 scin

M.E.Nahmias, T.Yuasa, Compt. rend. 239, 47 (1954).

β^- 2.9 Mg($\leq$30-Mev γ) scin$\beta\gamma$
~66% 3.8 scin
γ 7† 0.39 scin
9† 0.58
18† 0.97
7† 1.60

D.Maeder, P.Stähelin, Helv. Phys. Acta 27, 168A (1954).

Mg

$Mg(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

γ $Mg(n,n'\gamma)$ $E_n = 3.3$ scin
1.4 n'γ

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 92, 1507 (1953); 91, 441A (1953).

Mg^{23}
12 11
11^s

τ 10.7^s Mg($\leq$ 70-Mev γ)
β^+ 2.95 scin

W.A.Hunt, R.M.Kline, D.J.Zaffarano, Phys. Rev. 95, 611A (1954).

Mg^{24}
12 12
stable

Levels $Ne(\alpha,\alpha)$ $E_\alpha = 2$ to 4 pc
See also Mg^{26} $\alpha,\alpha(\theta)$

	J	Γ (kev)
11.405	1−	
11.476	0+	
11.542	2+	
11.751	0+	10
11.883	1−	8
11.985	2+	
12.288	3−	
12.481	1−	7
12.499	2+	5
12.531	4+	
12.601	2+	6

E.Goldberg, W.Haeberli, A.I.Galonsky, R.A.Douglas, Phys. Rev. 93, 799 (1954).

Resonances $Na^{23}(p,\gamma)$
0.3022 *6* Γ < 50 ev
0.5945 *15* Γ ~ 400 ev

O.M.Turner, Australian J. Sci. Res. 6, 380, (1953).

Mg^{24}
12 12
stable

Capture γ's $Na^{23}(p,\gamma)$ $E_p = 0.3022$

~25†	0.41	4†	6.2	scin
≤30†	0.63	3†	6.8	
~50†	0.80	6†	7.2	
~70†	1.38	44†	7.73	
20†	2.86	~1†	8.5	
14†	3.43	13†	9.2	
18†	3.89	7†	9.9	
28†	4.30	13†	10.6	
~2†	5.3	4†	11.2	
~3†	5.8	23†	11.8	

$\gamma\gamma$ coincidences support decay scheme

O.M.Turner, Australian J. Sci. Res. 6,380, (1953).

Capture γ's $Na^{23}(p,\gamma)$ $E_p = 0.305$

γ	1.38	scin
	4.2	3 cryst scin
	6.7	
	7.9	
	10.7 b = −0.24 p,$\gamma(\theta)$	

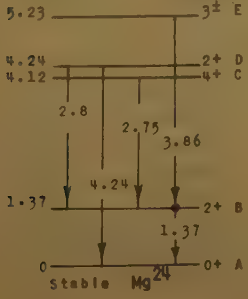
No 11.9 γ(<2% of 10.7 γ)
(1.38 γ) (10.7 γ) (7.9 γ) (4.2 γ)
(1.38γ, > 1.4γ) (> 1.4γ) (> 1.4γ)
Energy region between 1.5 and 3.0 not studied
No α's from 11.95 level (<20%)

R.R.Carlson, E.H.Geer, E.B.Nelson, Phys. Rev. 94, 1311(1954); 95, 650A (1954).

Levels $Na^{23}(p,\gamma)$ $E_p = 0.7$ to 1.5

J		Γ(kev)	Decay Modes*
1,2	12.414		D,B(0.26)
1	12.536		A,B(0.23)
3,4	12.647	<2	C,B(0.15)
2+	12.669	5	
1,2	12.677	6	D,B(0.3)
	12.738	<5	
2+	12.745	11	
1−	12.816	<4	A,B(0.8)
	12.826	<4	A,B(0.5),D(0.7)
	12.854	<4	D,B(0.3)
	12.862	<3	
	12.903	<3	
	12.930	9	E,B(0.26),D(0.75)
	12.967	4	B,A(0.2)
	12.975	5	
	13.004	<4	
3+	13.037	<2	E,B(0.35),B(0.07)?
4,5	13.059	<2	C
2−	13.097	11	E,D(1),B(0.1)

Proposed level scheme for capture γ's



(3.86 γ) (1.37 γ).
2.8 γ always found with 4.24 γ in ratio 1 : 5.
*Decay to g.s., 1.37 level, etc. indicated by A,B, etc. Relative intensities of weaker modes in brackets (strongest = 1).

J.O.Newton, Phys. Rev. 96, 241 (1954).

Mg^{24}
12 12
stable

Levels $Na^{23}(p,\gamma)$ $E_p = 0.85$ to 1.70

		Γ	γ's
6†	12.67	0.004	
9†	12.68	0.006	
8†	12.75	0.010	
16†	12.82	0.004	
12†	12.86	0.004	
14†	12.90	0.004	
57†	12.93	0.008	1.6
	12.97		1.4, 11.6
104†	12.98	0.010	1.6
12†	13.04	0.004	4.5, 8.5
12†	13.06	0.004	1.4, 2.8, 9.0
118†	13.10	0.012	1.6
353†	13.28	0.033	1.6

J.W.Teener, L.W.Seagondollar, R.W.Krone, Phys. Rev. 93, 1035 (1954).

Levels $Na^{23}(p,\gamma)$ $E_p = 1.0$ to 2.5
$Na^{23}(p,\alpha)$ scin, pc
52 levels 12.7-14.0 Γ's given

P.H.Stelson, W.M.Preston, Phys. Rev. 95, 974 (1954).

Mg^{25}
12 13
stable

Levels Mg(d,p) $E_d = 4.04$ s

g.s.	2.70	4.86 ?	6.09
0.50	2.87 ?	4.96 ?	6.25
1.00	3.92	5.15	6.54
1.58	4.03 ?	5.34	6.95
2.02	4.62	5.54	7.07 ?
2.47 ?			

Errors ~ 0.02

L.M.Khromchenko, Doklady Akad. Nauk SSSR 93, 451 (1953).

Mg^{26}
12 14
stable

Levels Ne(α,α) $E_\alpha = 2$ to 4 pc
13.388 J = 3− Γ = 2.5 kev
13.534 J = 3− Γ = 3.2 kev
Assignment based on relative intensities and isotopic abundances $\alpha,\alpha(\theta)$

E.Goldberg, W.Haeberli, A.I.Galonsky, R.A.Douglas, Phys. Rev. 93, 799 (1954).

Mg^{27}
12 15
9.5^m

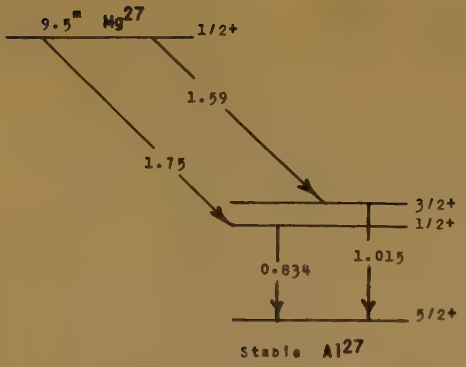
Mg(13-Mev d) chem

β^-	42%	1.59	sl
	58%	1.75	
γ		0.834	sl pe⁻
		1.015	

No 2.6 β

(CONTINUED)

Mg^{27}
12 15
9.5^m



H.Daniel, W.Bothe, Z.Naturf. 9a, 402(1954).

$E_\gamma/\beta = 0.88 \pm 0.08$ Mev a
Confirms decay scheme of Daniel et al.
Z.Naturf. 8a, 447(1953); 9a, 402(1954).

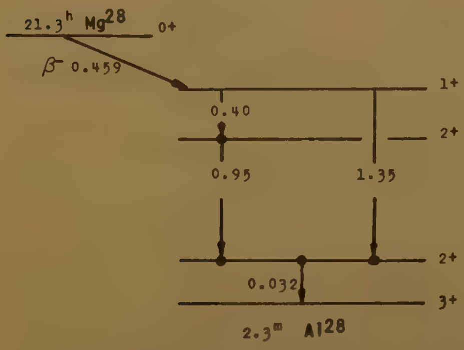
L.Koester, Z.Naturf. 9a, 104 (1954).

Mg^{28}
12 16
21.4^h

β^- 0.459 F-K plot linear sl
Cl(340-Mev p) chem

J.L.Olsen, G.D.O'Kelley, Phys. Rev. 93, 1125 (1954).

p 2.3^mAl Mg(39-Mev α) chem
τ 21.3^h Si($\leq$100-Mev γ) chem
β^- 0.40 a
γ 96† 0.0319 $\alpha_K = 0.032$ M1 scin
$\tau < 2\times10^{-9s}$
31† 0.40
29† 0.95
70† 1.35
$(0.0319\gamma)(0.40\gamma, 0.95\gamma, 1.35\gamma)$
$(0.40\gamma)(0.95\gamma)$
No γ with $E_\gamma > 2.0$ (< 1†)
1.015 Al^{28} level not populated by 21.4^hMg



R.K.Sheline, N.R.Johnson, P.R.Bell, R.C.Davis, F.K.McGowan, Phys. Rev. 94, 1642(1954); 90, 325(1953); 89, 520 (1953).

Al^{24}
13 11
2.1^s

τ 2.0^s Mg(< 20-Mev p)
β^+ scin
γ 1.38 5.4 scin
2.70 5.7 ?
4.2 7.0
$\alpha/(>$ 1-Mev $\gamma) \sim 0.003$ scin

S.W.Breckon, A.Henrikson, W.M.Martin, J.S.Foster, Can. J. Phys. 32, 223 (1954).

γ 7.1 Mg(20-Mev p) scin
Four lower energy γ's
α's

N.W.Glass, J.R.Richardson, Phys. Rev. 93, 942A (1954).

Al^{25}
13 12
7.6^s

β^+ 3.2 Mg(0.25-Mev p); a
(β^+)(1.0-to 2.5-Mev γ) $\leq$ (9 ± 8)%

S.E.Hunt, W.M.Jones, J.L.W.Churchill, Proc. Phys. Soc. 67A, 479 (1954).

τ 7.62^S *13*
$Mg^{24}(p,\gamma)$ EA

Level	E_o	Γ
2.51	0.2255 *3*	0.006
2.69	0.4184 *4*	0.0025

S.E.Hunt, W.M.Jones, J.L.W.Churchill, D.A.Hancock, Proc. Phys. Soc. 67A, 443(1954); Phys. Rev. 89, 1283 (1953); Nature 172, 460 (1953).

Level Mg(p,γ) $E_p = 0.222$
2.51 level
γ 0.47 *2*
2.03 *2*
$(0.47\gamma)(2.03\gamma)$
No 2.5 γ (< 2% of 2.03 γ)
$P_2(2.03\gamma)(\theta)$ isotropic

D.S.Craig, W.G.Cross, R.G.Jarvis, Phys. Rev. 96, 825 A (1954).

Al^{26}
13 13
6.7^s

τ_1 6.5^S *1* Al^{27}(13.4-Mev γ)
β^+ 3.2 a

R.N.H.Haslam, W.N.Roberts, D.S.Robb, Can. J. Phys. 32, 361 (1954).

τ_1 6.68^S *11*
Resonances $Mg^{25}(p,\gamma)$ EA

E_o	Γ
0.3167 *7*	0.012
0.3915 *5*	0.008
0.4956 *6*	0.005
0.5134 *7*	0.003
0.5304 *7*	0.003

S.E.Hunt, W.M.Jones, J.L.W.Churchill, D.A.Hancock, Proc. Phys. Soc. 67A, 443 (1954); Nature 172, 460 (1953).

Al^{26}
13 13
6.7^s

Resonances $Mg^{25}(p,\gamma)6.7^s Al^{26}$
$E_p = 0.3$ to 1.2

0.39
0.49
0.51
0.56
0.59
0.65
0.68
0.72
0.78
0.81
0.88
0.93
0.99
1.04
1.08
1.10
1.13
1.20

W.E.Taylor, L.N.Russell, J.N.Cooper, Phys. Rev. 93, 1056 (1954).

Al^{26}
13 13
long

Level $Al^{27}(p,d)Al^{26}$ $E_p = 18$
g.s.? $l_n = 2$ p,d(θ)

J.B.Reynolds, K.G.Standing, Phys. Rev. 95, 639A (1954).

Levels Si(d,α) $E_d = 7$ s
g.s.
0.418
1.052
1.750
1.85 ?
2.064

Only T = 0 levels expected from this reaction
No level between g.s. and 0.42 (< 3% of g.s.)

C.P.Browne, Phys. Rev. 95, 860 (1954).

Resonances $Mg^{25}(p,\gamma)$ $E_p = 0.2$ to 0.7

E_0	γ's		
0.315	18†	6.28	
0.389	8†	6.20	
0.436	6†	6.28	25† 6.77*
0.508	10†	6.38	
0.586	18†	6.43	
0.620	19†	6.50	

†Relative intensity in % of γ's with $E_\gamma > 1$
β^+ yield low at 0.436 resonance
*Suggest this γ to g.s.

J.C.Kluyver, C. van der Leun, P.M.Endt, Phys. Rev. 94, 1795 (1954).

Al^{27}
13 14
stable

Level $Al^{27}(p,d)Al^{26}$ $E_p = 18$
g.s. $l_n = 2$ See Al^{26}

J.B.Reynolds, K.G.Standing, Phys. Rev. 95, 639A (1954).

$Al^{27}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

Levels $Al^{27}(n,n'\gamma)$ $E_n = 0.8$ to 2.7
γ scin
0.85
1.03
2.23

Graphs of σ's from threshold to 2.7

R.M.Kiehn, C.Goodman, Phys. Rev. 95, 989 (1954).

Al^{27}
13 14
stable

Level $Al^{27}(n,n'\gamma)$ $E_n = 3.3$ scin
γ n'γ
0.82
1.02
2.34

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 92, 1507 (1953); 91, 441A (1953).

Levels $Mg^{26}(p,\gamma)$ $E_p = 0.3$ to 1.5
8.591
8.694
8.898
8.954
9.045
9.070
9.179
9.216
9.238
9.277
9.391
9.470
9.509
9.633
9.671

L.N.Russell, W.E.Taylor, J.N.Cooper, Phys. Rev. 95, 99 (1954).

Capture γ's Mg(p,γ) scin

8.68 level $E_p = 0.454$

0.81
2.3
2.8
4.1
4.6
5.7
6.5
7.9
8.7

J.C.Kluyver, G.Verploegh, Physica 20, 178 (1954).

Capture γ's Mg(p,γ) scin

8.68 level $E_p = 0.449$

0.8
2.8
5.9
8.0

8.90 level $E_p = 0.660$

0.8
1.0
2.8
5.5
6.2
8.0

9.23 level $E_p = 1.011$

0.8
1.0
2.8
6.2
8.5

9.27 level $E_p = 1.053$

0.8
1.0
2.7
5.6
6.7
8.65
9.3

J.A.Smith, J.N.Cooper, J.C.Harris, Phys. Rev. 94, 749A (1954); verbal report.

Al^{28}
13 15
2.3^m

β^- 2.8 Al^{27}(pile n); a
γ 1.83 scin
(2.8 β) (1.83 γ) βγ/β not $f(E_\beta)$

M.E.Nahmias, J. phys. radium 15, 568 (1954); Compt. rend. 238, 187* (1954).

β^- 2.88 d 21.4^hMg; sl
< 0.8% (4.66)

J.L.Olsen, G.D.O'Kelley, Phys. Rev. 93, 1125 (1954).

Al^{28} γ 1.77 d 21.4^{h}Mg chem scin
13 15
2.3^{m}

R.K.Sheline, N.R.Johnson, P.R.Bell, R.C.Davis, F.K.McGowan, Phys. Rev. 94, 1642(1954); 90, 325 (1953).

No 2.4 γ* ($<$ 1% of 1.8 γ) $\beta\gamma$ scin
*Gentner, Maier-Leibnitz, unpublished

Th. Mayer-Kuckuk, Z. Naturf. 9a, 338 (1954).

Resonance Al^{27}(n)
0.0064 $\sigma_o = 88$ $\Gamma \sim 12$ ev $l_n = 1$

R.H.Rohrer, H.W.Newson, J.H.Gibbons, P.Cap, Phys. Rev. 95, 302A (1954).

Levels Al^{27}(d,p) $E_d = 4.31$ s

0.980	3.747?	5.396	6.641
1.597	3.934	5.643?	6.855
2.152	4.277	5.784	7.013
2.574	4.469	5.968	7.197
2.929	4.720	6.148	7.599?
3.334?	4.883	6.298	7.896?
3.520	5.170	6.438	

L.M.Khromchenko, Doklady Akad. Nauk SSSR 94, 1037 (1954).

Al^{29} Mg(56-Mev α) chem
13 16
6.6^{m}

β^- ~25% 1.6 a$\beta\gamma$
γ 1.31 scin
2.42
(1.6 β) (2.42 γ)

M.E.Nahmias, A.H.Wapstra, J. phys. radium 15, 570 (1954); Compt. rend. 238, 1875 (1954).

Si Si(α,$\alpha'\gamma$) $E_\alpha = 3.0$
scin
No γ with $E_\gamma < 0.5$

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

Si^{27} τ 4.0^{s} Si($\leq$70-Mev γ)
14 13
4.0^{s}

β^+ 3.76 scin

W.A.Hunt, R.M.Kline, D.J.Zaffarano, Phys. Rev. 95, 611A (1954).

Si^{28} Level Al^{27}(p,γ) $E_p = 0.65$ to 2.2
14 14
stable

(1.78) I = 2+ or 3+ p,γ(θ)

H.E.Gove, E.B.Paul, G.A.Bartholomew, A.E.Litherland, Phys. Rev. 94, 749A(1954); verbal report.

Si^{28} Capture γ's Al^{27}(p,γ) scin
14 14
stable

11.99 level $E_p = 0.404$ J = 4-

1.13 ? 2.8 7.3
1.84 5.1 10.2

(p), (7.3γ)(θ) b = + 0.31 No α's observed*

12.09 level $E_p = 0.503$ J = 2+

1.18 ? 2.8 7.3 12.1
1.84 5.1 10.3

(p), (10.3γ)(θ) b = 0 α emitting level*

12.21 level $E_p = 0.630$ J = 3-

1.13 ? 2.8 5.1 10.4
1.84 3.5 7.6

(p), (10.4γ)(θ) b = -0.11 α emitting level*

12.23 level** $E_p = 0.652$ J = 2-

5.1 7.5 10.4 12.2

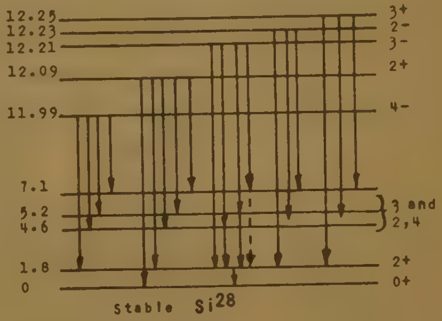
(p), (7.5γ)(θ) b = -0.48 No α's observed*
(p), (10.4γ)(θ) b = -0.12

12.25 level** $E_p = 0.677$ J = 3+

7.5 10.4

(p), (10.4γ)(θ) b = 0 No α's observed*

*α yield data of J.G.Rutherglen, R.D.Smith, Proc. Phys. Soc. 66A, 800 (1953).
**Low energy γ spectrum not measured



J.G.Rutherglen, P.J.Grant, F.C.Flack, W.M.Deuchars, Proc. Phys. Soc. 67A,101(1954).

γ Al^{27}(p,γ) $E_p = 0.660$
(10.4) E1* D(γ,p) in ppl
*From polarization of γ-ray

I.S.Hughes, P.J.Grant, Proc. Phys. Soc. 67A, 481 (1954).

Si^{29} I 1/2 S
14 15
stable

R.A.Ogg, Jr., J.D.Ray, J. Chem. Phys. 22, 147, (1954).

I 1/2 Si^{29}F$_4$ I

G.A.Williams, D.W.McCall, H.S.Gutowsky, Phys. Rev. 93, 1428 (1954).

Si^{29}
14 15
stable

I 1/2 Mic
Q $<1\times10^{-4}$

R.L.White, C.H.Townes, Phys. Rev. 92,1256(1953).

Si^{30}
14 16
stable

Levels $Al^{27}(\alpha,p)$ $E_\alpha \leq 5.3$ ppl
100† g.s.
138† 2.27
†Relative numbers the same for both 13.2 and 13.5 level of P^{31}, q.v.
$\alpha,p(\theta)$ for four proton groups given

R.R.Roy, J.Quequin, P.Janssens, Bull. centre phys. nucléaire univ. libre Bruselles, No. 31, (1951).

Si^{31}
14 17
2.65^h

γ 0.07% 1.26 scin
No lower energy γ's Si(pile n) chem

W.S.Lyon, J.J.Manning, Phys. Rev. 93,501(1954).

Si^{32}
14 18
$\sim700^y$

D 14.3^dP, chem Si(pile n)
$\tau(Si^{32}) = 600\,\sigma[Si^{31}(\text{pile } n,\gamma)]$ years

A.Turkevich, A.Samuels, Phys. Rev. 94,364(1954)..

P^{28}
15 13
0.28^s

τ 0.29^s Si(15.4-Mev p)
β^+ scin
γ 1.78 5.5 ? scin
2.67 6.6
3.01 ? 7.1
4.3 ? 7.4 ?
4.6 7.7
4.89 8.1 ?
5.2 ?
$\alpha/(>1$ Mev γ's$) < 0.001$ scin

S.W.Breckon, A.Henrikson, W.M.Martin, J.S.Foster, Can. J. Phys. 32, 223 (1954).

β^+ 10.6 Si(20-Mev p) scin
γ 7.6
Six or seven lower energy γ's
No heavy particles

N.W.Glass, J.A.Richardson, Phys. Rev. 93,942A (1954).

P^{29}
15 14
4.6^s

β^+ ~3% ~2.6 Si(3-Mev d), sl
3.945 *10*
γ ~1.5% (1.28)

H.Roderick, C.Wong, Phys. Rev. 92, 204(1953).

P^{30}
15 15
2.5^m

τ 2.5^m $P^{31}(\leq 30\text{-Mev } \gamma)$
No γ scin
No shorter lived activity observed

P.Stähelin, Helv. Phys. Acta 26,691(1953).

P^{30}
15 15
2.5^m

τ 2.55^m S(13-Mev d)
β^+ 3.23 a
No γ $(E_\gamma/\beta < 0.1$ Mev) a

L.Koester, Z.Naturf. 9a, 104 (1954).

τ 2.6^m $P^{31}(p)$
β^+ 3.24 *6* simple sl
No γ scin

D.Green, J.R.Richardson, Phys. Rev. 96, 858A (1954).

β^+ 3.31* $P^{31}(\leq 70\text{-Mev } \gamma)$; scin

W.A.Hunt, R.M.Kline, D.J.Zaffarano, Phys. Rev. 95, 611A (1954); *verbal report.

Capture γ's $Si^{29}(p,\gamma)$ scin
5.87 level $E_p = 0.326$
5.86
5.95 level $E_p = 0.414$
0.688
5.27
No other prominent resonances for $E_p \leq 0.700$

P.M.Endt, J.C.Kluyver, C. van der Leun, Phys. Rev. 95, 580 (1954).

P^{31}
15 16
stable

$P^{31}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Levels $Al^{27}(\alpha,p)$
13.2 $\Gamma = 0.36$ cc
13.5 $\Gamma = 0.30$

R.R.Roy, C.Godeau, Phil. Mag. 44,1184(1953).

Levels $Al^{27}(\alpha,p)$ $E_\alpha \leq 5.3$ ppl
13.2
13.5 See Si^{30}

R.R.Roy, J.Quéquin, P.Janssens, Bull. centre phys. nucléaire univ. libre Bruxelles, No. 31 (1951).

P^{32}
15 17
14.3^d

β^- 1.711 *6* sl

H.Daniel, W.Bothe, Z.Naturf. 9a,402(1954).

$e^+/e^- < 10^{-6}$ trochoidal s
No $(e^+)(e^-) < 3\times10^{-5}$ per disintegration $s\pi$*
*Path length 4.7 cm

P.Weinzierl, Z. Naturf. 9a, 69 (1954).

$e^+/e^- < 8\times10^{-6}$ s*
*Path length 6 cm

G.W.McClure, Phys. Rev. 94, 1637 (1954); 91, 483A (1953).

P^{32}
15 17
14.3^d

Inner bremsstrahlung spectrum (0.08 to 0.9) has allowed shape

N.Goodrich, W.B.Payne, Phys. Rev. 94,405(1954).

P^{33}
15 18
24.4^d

τ 24.4^d S^{33}(pile n) chem
β^- 0.249 sl

R.T.Nichols, E.N.Jensen, Phys. Rev. 94, 369 (1954).

β^- 0.251 S(th n) chem 85% P^{33};s
S(pile n) ms 70% P^{33}

B.Elbek, K.O.Nielsen, O.B.Nielsen, Phys. Rev. 95, 96 (1954).

S

$S(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

S^{31}
16 15
2.4^s

τ 2.40^s $S(\leq 70\text{-Mev } \gamma)$
β^+ 4.5 scin

W.A.Hunt, R.M.Kline, D.J.Zaffarano, Phys. Rev. 95, 611A (1954).

S^{32}
16 16
stable

Capture γ's $P^{31}(p,\gamma)$ $E_p = 0.4$ to 1.2 scin

9.4 level
0.7 2.2 5.0 8.0
1.4 3.8 7.4

9.5 level
2.2 4.3 5.5 7.6

9.6 level
0.6 3.9 5.4 7.6
2.2

9.95 level
2.2 5.3 8.0 10.1
4.5

9.98 level
2.2 4.4 5.5 8.0

J.A.Smith, J.N.Cooper, J.C.Harris, Phys. Rev. 94, 749A (1954); verbal report.

S^{33}
16 17
stable

Q -0.06 Mic

G.R.Bird, C.H.Townes, Phys. Rev. 94,1203(1954).

Level $A^{36}(n,\alpha)$ $E_n = 2.15$ to 4.40
0.9 pc
(Incorrectly given as 1.1 in NSA 7)

B.J.Toppel, S.D.Bloom, Phys. Rev. 91,473A(1953).

S^{35}
16 19
87^d

μ 1.00 OCS^{35} Mic
Assumed positive

B.F.Burke, M.W.P.Strandberg, V.W.Cohen, W.S. Koski, Phys. Rev. 93, 193 (1954).

S^{35}
16 19
87^d

No β^-'s with $E_\beta < 10$ kev found from $C_2H_5S^{35}H$ in cc

G.J.Plain, H.L.Morrison, P.H.Pitkanen, F.T. Rogers, Jr., Phys. Rev. 92,529A(1953).

Cl

$Cl(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Cl^{32}
17 15
0.31^s

τ 0.32^s S(14.5-Mev p)
β^+ scin
γ 2.25 scin
3.79 ?
4.33
4.82
$\alpha/(>1 \text{ Mev } \gamma\text{'s}) < 0.0005$ scin

S.W.Breckon, A.Henrikson, W.M.Martin, J.S.Foster, Can. J. Phys. 32, 223 (1954).

β^+ 9.4 S(20-Mev p) scin
γ 4.77
Three lower energy γ's
α's

N.W.Glass, J.R.Richardson, Phys. Rev. 93,942A (1954).

Cl^{33}
17 16
2.8^s

γ ~0.3% 2.85*

W.E.Meyerhof, G.Lindstrom, Phys. Rev. 93, 949A(1954); *verbal report.

Cl^{34}
17 17
32.4^m

τ_1 32.40^m *4* Cl(p)
β^+ 1.33 *10* sl
2.48 *7*
4.50 *3*

D.Green, J.R.Richardson, Phys. Rev. 96, 858A (1954).

No $(0.145\ \gamma)(\beta^+)$ No $(0.145\ \gamma)(\gamma)$

Th. Mayer-Kuckuk, Z. Naturf. 9a, 338 (1954).

Cl^{34}
17 17
1.5^s

τ_2 1.58^s d 32.4^mCl chem

W.Arber, P.Stähelin, Helv. Phys. Acta 26,584A,691 (1953); Phys. Rev. 92, 1076(1953).

Cl^{35}
17 18
stable

$\nu(Cl^{35})/\nu(Cl^{37}) = 1.2684$ *1* $HgCl_2$ quad res

H.G.Dehmelt, H.G.Robinson, W.Gordy, Phys. Rev. 93, 480(1954); 93, 920A(1954).

Cl^{36}
17 19
4.4×10^5 y

Capture γ's $Cl(n,\gamma)$ scin
$(0.784\ \gamma)(7.77\ \gamma)$ $(1.15\ \gamma)(7.42\ \gamma)$
$(1.59\ \gamma)(6.98\ \gamma)$ $(2.00\ \gamma)(6.62\ \gamma)$
$(0.784\ \gamma)(6.12\ \gamma)$ $(0.735\ \gamma)(7.7\ \gamma)$?

A.L.Recksiedler, B.Hamermesh, Phys. Rev. 96, 108 (1954); 95, 650A (1954).

Cl^{38}
17 21
1.0^s

τ_1 1.0^s Cl^{37}(pile n)
γ 0.66 scin

G.Scharff-Goldhaber, M.McKeown, Phys. Rev. 95, 613A (1954).

Cl^{38}
17 21
37.3^m

γ (1.60) $\tau < 4\times10^{-10s}$
(1.60 γ) (2.15 γ) (θ) I = 3, 2, 0

J.J.Kraushaar, J.W.Mihelich, A.W.Sunyar, Phys. Rev. 95, 456 (1954).

A^{37}
18 19
34^d

E_{dis} 0.82 scin
From continuous γ endpoint

S.E.Singer, W.S.Emmerich, J.D.Kurbatov, Phys. Rev. 94,113,779A (1954).

Intensity of low energy γ's in continuous γ spectrum is higher than that predicted for capture of $l = 0$ electrons. See theory which includes capture of $l = 1$ electrons [Phys. Rev. 95, 572 (1954)].

B.Saraf, Phys. Rev. 95, 612A (1954).

Double K vacancy /K capture = 3.9×10^{-4} pc
for e's with $E_e \leq 0.004$ ($\sim$73% of expected e's)

J.A.Miskel, M.L.Perlman, Phys. Rev. 94, 1683 (1954); 95, 612A (1954).

A^{38}
18 20
stable

Levels $Cl^{35}(\alpha,p)$ $E_\alpha = 7.45$
2.13 a
3.73

A.Z.Kranz, W.W.Watson, Phys. Rev. 91,1472(1953).

A^{41}
18 23
1.8^h

τ 1.80^h V(187-Mev p)
Assignment confirmed with ms No chem

G.Andersson, Phil. Mag. 45, 621 (1954).

K

$K(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

K^{38}
19 19
0.95^s

τ_1 0.95^s K($\leq$31-Mev γ)
β^+ (4.57)*
$\sigma(0.95^s K)/\sigma(7.7^m K) = \sim1$ $E_\gamma \leq 16$ to $E_\gamma \leq 31$
Suggest this is I = 0^+ and T = 1 state
*Formerly assigned to K^{37}

P.Stähelin, Helv. Phys. Acta 26,691(1953); Phys. Rev. 92,1076(1953). *F.I.Boley, D.J. Zaffarano, Phys. Rev. 84,1059(1951).

K^{38}
19 19
7.7^m

τ_2 7.7^m *3* K(p)
β^+ 2.68 *4* simple sl
No ce^- sl

D.Green, J.R.Richardson, Phys. Rev. 96, 858A (1954).

K^{39}
19 20
stable

μ +0.39087 *1* KCO_2H I

E.Brun, J.Oeser, H.H.Staub, C.G.Telschow, Phys. Rev. 93, 172 (1954).

K^{40}
19 21
1.3×10^{9y}

$\epsilon_K = 1.42 \pm 0.23$ per gram of K per sec pc
From x rays/gm/sec and fluorescence yield = 0.12 ± 0.01

J.Heintze, Z. Naturf. 9a, 469 (1954).

$\epsilon/\beta^- = 0.090$ ms
Former value of 0.060* increased by more complete A extraction

H.A.Shillibeer, R.D.Russell, R.M.Farquhar, E.A.W.Jones, Phys. Rev. 94, 1793 (1954); *91, 1223 (1953).

$A^{40}/K^{40} = 0.0537 \pm 0.0014$ for one of feldspar samples for which Russell et al found 0.037 ± 0.004. Estimate feldspar age < Russell value, use same τ_{total}, conclude $\epsilon/\beta^- \sim 0.13$

G.J.Wasserburg, R.J.Hayden, Phys. Rev. 93,645 (1954); * R.D.Russell, H.A.Shillibeer, R.M.Farquhar, A.K.Mousuf, Phys. Rev. 91,1223 (1953).

K^{41}
19 22
stable

μ +0.21453 *3* KCO_2H I
$\nu(K^{41})/\nu(K^{39}) = 0.54886$ *8*

E.Brun, J.Oeser, H.H.Staub, C.G.Telschow, Phys. Rev. 93, 172 (1954).

K^{42}
19 23
12.5^h

τ 12.5^h V(187-Mev p)
Assignment confirmed with ms No chem

G.Andersson, Phil. Mag. 45, 621 (1954).

β^- 18.2%* 1.97 F-K linear sl $\beta\gamma$
(< 15% ΔI = 2, yes shape)*
81.8%* 3.56 ΔI = 2, yes shape sl

L.Koerts, A.Schwarzschild, R.Gold, C.S.Wu, Phys. Rev. 95, 612A (1954); *verbal report.

γ 1.5†* 0.309 scin
100†* (1.51)

M.M.Lazar, P.R.Bell, Phys. Rev. 95, 612A (1954); *verbal report.

No (2.04 β) (1.51 γ) polarization-direction

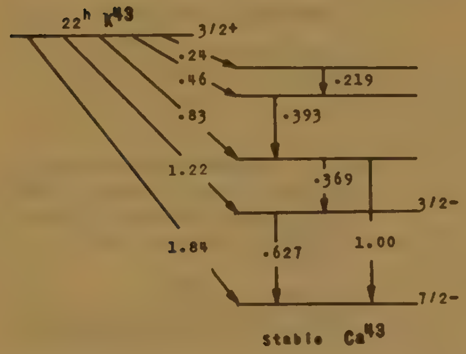
D.R.Hamilton, A.Lemonick, F.M.Pipkin, Phys. Rev. 92. 1191(1953); 90, 370A(1953)

K^{43}
19 24
22^h

τ 22.4^h V(187-Mev p)
Assignment confirmed with ms No chem

G.Andersson, Phil. Mag. 45, 621 (1954).

K^{43} 19 24 22^h	τ		22.0^h	A(~18-Mev α)	chem
	β^-	5%	0.24		sl
		5%	0.46		
		83%	0.83		
		5%	1.22		
		2%	1.84	$\Delta I = 2$, yes shape	
	γ	1†	0.219		sl pe^-
		67†	0.369		
		6†	0.393		
		100†	0.627	$\alpha_K \sim 2 \times 10^{-4}$	
		4†	1.00		



T.Lindqvist, A.C.G.Mitchell, Phys. Rev. 95, 444, 612A (1954).

K^{44} 19 25 22^m	τ	20^m	V(187-Mev p)	
	Assignment confirmed with ms		No chem	

G.Andersson, Phil. Mag. 45, 621 (1954).

τ	22.0^m	Ca^{44}($\leq$20-Mev n)	chem
β^-	1.5		scin
	4.9		
γ	1.13		scin
	2.07		
	2.48		
	3.6 ?		

Other unresolved γ's with $E_\gamma < 0.5$

B.L.Cohen, Phys. Rev. 94, 117 (1954).

K^{45}? 19 26 34^m	τ	34^m	V(187-Mev p), ms
	Yield suggests element is K		No chem

G.Andersson, Phil. Mag. 45, 621 (1954).

Ca	Ca(α,$\alpha'\gamma$)	$E_\alpha = 3.0$	
	No γ with $E_\gamma < 0.5$		scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

Ca^{39} 20 19 1.0^s	τ	0.90^s	Ca($\leq$70-Mev γ)	
	β^+	6.1		scin

W.A.Hunt, R.M.Kline, D.J.Zaffarano, Phys. Rev. 95, 611A (1954).

Ca^{41} 20 21 1.1×10^{5y}	τ	$1.1 \times 10^{5y*}$ 3		pc
	Potassium x ray			crit a
	*Based on $\sigma_a(Ca^{40}) = 0.22$ and fluorescence yield = 0.13		Ca^{40}(pile n)	chem

F.Brown, G.C.Hanna, L.Yaffe, Proc. Roy. Soc. 220A, 203 (1953); Phys. Rev. 84, 1243 (1951).

Ca^{43} 20 23 stable	I	7/2	s
	μ	-1.2	

F.M.Kelley, H.Kuhn, A.Pery, Proc. Phys. Soc. 67A, 450 (1954).

Levels	Ca^{42}(d,p)	$E_d = 5^*$	s
	0.38	1.00	
	0.61	1.40	

C.M.Braams, Phys. Rev. 95, 650A (1954);
* verbal report.

Ca^{45} 20 25 164^d	Levels	Ca^{44}(d,p)	$E_d = 5^*$	s
		0.18	2.84	
		1.43	2.96*	
		1.89	3.24*	
		2.25*	3.32*	
		2.40*	3.42*	

C.M.Braams, Phys. Rev. 95, 650A (1954);
* verbal report.

Ca^{47} 20 27 4.8^d	τ		4.3^d 2	Cr(420-Mev p)	chem
	β^-	81%	0.685		sl
		19%	2.060	F-K plot linear	

L.Marquez, Phys. Rev. 92, 1511 (1953).

τ		5.4^d 1	Ca^{46}(pile n)	chem
β^-	60%	0.46		sm 2
	40%	1.40		
γ		0.1495		sm ce_K^-
		0.234		ce_K^-
		0.495		ce^-, pe^-
		0.80		pe^-
		1.30		pe^-

(> 0.6β)(~ 0.2γ)

J.M.Cork, J.M.LeBlanc, M.K.Brice, W.H.Nester, Phys. Rev. 92, 367 (1953).

β^-	~80%	0.8	Ca(26-Mev d)	chem;	a
	~20%	2.0	Ti(26-Mev d)	chem	
γ		1.3		scin	

A.H.W.Aten, Jr., E.Greuell, W.J.van Dijk, Physica 19, 1049 (1953).

Sc^{40} 21 19 0.22^s	τ	0.22^s	Ca(15.9 ± 1.0-Mev p)	
	β^+	9.0		scin
	γ	3.75		
	No heavy particles			No other γ

N.W.Glass, J.R.Richardson, Phys. Rev. 93, 942A (1954).

Sc^{43} 21 22 4.0^h	τ	3.84^h	V(187-Mev p)	
	Assignment confirmed with ms		No chem	

G.Andersson, Phil. Mag. 45, 621 (1954).

Sc^{43}
21 22
4.0^h

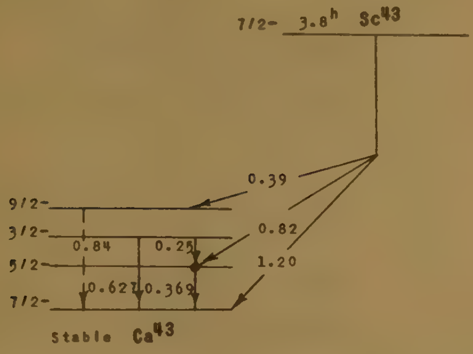
γ	25†	0.375	scin

†Percent of β^+

R.H.Nussbaum, R. van Lieshout, A.H.Wapstra, Phys. Rev. 92, 207 (1953).

τ		3.8^h	Ca(~20-Mev α)
β^+	4†	0.39	sl
	17†	0.82	
	79†	1.20	
γ	1†	0.25	sl pe^-
	16†	0.369	
	4†	0.627	
	W	0.84	scin

$(0.82\ \beta^+)(0.369\ \gamma)$



T.Lindqvist, A.C.G.Mitchell, Phys. Rev. 95, 444, 612A (1954).

Sc^{44}
21 23
2.4^d

τ_1	2.46^d	V(187-Mev p)
Assignment confirmed with ms		No chem

G.Andersson, Phil. Mag. 45, 621 (1954).

Sc^{44}
21 23
4.0^h

τ_2	3.90^h	V(187-Mev p)
Assignment confirmed with ms		No chem

G.Andersson, Phil. Mag. 45, 621 (1954).

$0.511\gamma/1.16\gamma = 1.96 \pm 0.15$ scin
Na^{22} comparison ($\epsilon = 10\%$)
$\beta^+/(\epsilon+\beta^+) = 0.98 \pm 0.08$
Theory gives $\beta^+/(\epsilon+\beta^+) = 0.96$

H.Langevin, N.Marty, J. phys. radium 15, 127 (1954).

Sc^{45}
21 24
stable

$Sc^{45}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954); priv. comm.

Sc^{46}
21 25
84^d

β^- 0.10% 1.25 log $f_ot = 11.3$ sl
Shape fitted by C_{2T} ($\Delta I = 2$, no) not ($\Delta I = 3$, no)

G.L.Keister, F.H.Schmidt, Phys. Rev. 93, 140 (1954); 91, 483A (1953).

Sc^{46}
21 25
84^d

γ	(0.89)	$\alpha = 1.6 \times 10^{-4}$	sl
	(1.12)	$\alpha = 8.2 \times 10^{-5}$	

G.L.Keister, Phys. Rev. 96, 855A (1954).

γ	(0.89)	$\alpha = 1.3 \times 10^{-4}$	sl ce^-
	(1.12)	$\alpha = 2.6 \times 10^{-4}$	

E.F.Sturcken, Z.O'Friel, A.H.Weber, Phys. Rev. 93, 1053 (1954).

No delayed $\gamma\gamma$ ($\tau < 10^{-6s}$)

H.S.Murdoch, A.J.Webb, Proc. Phys. Soc. 67A, 286 (1954).

Sc^{47}
21 26
3.43^d

τ	3.3^d	V(187-Mev p)
Assignment confirmed with ms		No chem

G.Andersson, Phil. Mag. 45, 621 (1954).

τ		3.44^d 5		d 4.8^dCa	
β^-	28%	0.280	F-K plot linear		sl
	72%	0.490	F-K plot linear		
γ		~0.22			sl ce^-

L.Marquez, Phys. Rev. 92, 1511 (1953).

τ	3.40^d 5	d 4.8^dCa	
β^-	0.64		$s\pi\sqrt{2}$
γ	0.1595	K/LM~10	$s\pi$ ce^-

$(0.64\beta)(0.16\gamma)$

J.M.Cork, J.M.LeBlanc, M.K.Brice, W.H.Nester, Phys. Rev. 92, 367 (1953).

Sc^{48}
21 27
1.83^d

τ	1.83^d	V(187-Mev p)
Assignment confirmed with ms		No chem

G.Andersson, Phil. Mag. 45, 621 (1954).

γ	100†	(0.98)	Ti(≤ 18-Mev n)	scin
	100†	1.04		V^{48} comparison
	100†	(1.32)		

$\gamma\gamma\gamma$

H.Casson, L.S.Goodman, V.E.Krohn, Phys. Rev. 92, 1517 (1953).

$(1.04\gamma)(0.98\gamma)(\theta)$ I = 6, 4, 2, 0

C.E.Whittle, P.S.Jastram, Phys. Rev. 92, 205, (1953).

Sc^{49}
21 28
57^m

τ	57^m	Ca(13-Mev d)	chem
β^-	2.00		a
No γ ($E_\gamma/\beta < 0.05$ Mev)			a

L.Koester, Z.Naturf. 9a, 104 (1954).

Ti
Capture γ's Ti(n,γ) scin
0.334
1.06 to 1.10 2 unresolved γ's
1.39
1.53 to 1.58 2 unresolved γ's
1.75 See Ti^{49}
γ energy range observed 0.1 to 2.0

M.Reier, M.H.Shamos, Phys. Rev. 95, 636A (1954).

Ti^{44}
22 22
2.7^y
τ 2.7^y Sc^{45}(30-Mev p) chem
γ 0.16 scin
p 4.0^hSc chem Not p 2.4^dSc

R.A.Sharp, R.W.Diamond, Phys. Rev. 93,358 (1954).

Ti^{45}
22 23
3.07^h
τ 3.0^h V(187-Mev p)
Assignment confirmed with ms No chem

G.Andersson, Phil. Mag. 45, 621 (1954).

No 0.45γ (< 1.5% of β^+) scin, $\beta\gamma$

R.H.Nussbaum, R.van Lieshout, A.H.Wapstra, Phys. Rev. 92, 207(1953).

Ti^{47}
22 25
stable
I 5/2 $Ti^{47}Cl_4$ I
μ -0.78711* 1
*From $\nu(Ti^{47})/\nu(D) = 0.36721$ 6
Also $\nu(Ti^{47})/\nu(Cl^{35}) = 0.57493$ 6

C.D.Jeffries, Phys. Rev. 92,1262,1096A(1953).

Level $Ti^{47}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
γ 0.16* scin
No 0.433 γ* Enriched material used*

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954); *priv. comm.

Ti^{48}
22 26
stable
Q values $Ti^{47}(d,p)$ $E_d = 10.2$ ppl
d,p(θ)

	l_n	
8.14	3	g.s. ?*
6.81	1 (3?)	
5.83	1	
4.83	1	

*Higher energy p group required by mass values not observed (< 3% of Q = 8.14 group)

M.M.Bretscher, J.O.Alderman, A.Elwyn, F.B. Shull, Phys. Rev. 96, 103, 826A (1954).

Ti^{49}
22 27
stable
I 7/2 $Ti^{49}Cl_4$ I
μ -1.1023* 2
*From $\nu(Ti^{49})/\nu(D) = 0.36731$ 6
Also $\nu(Ti^{49})/\nu(Cl^{35}) = 0.57508$ 6

C.D.Jeffries, Phys. Rev. 92,1262,1096A(1953).

Ti^{49}
22 27
stable
Levels $Ti^{48}(d,p)$ $E_d = 10.2$ ppl

	l_n
g.s.	3
1.35	1
1.70	1
2.41	1, 2

M.M.Bretscher, J.O.Alderman, A.Elwyn, F.B.Shull, Phys. Rev. 96, 103, 826A (1954).

Capture γ's Ti(n,γ) sl pe^-
0.346*
0.511 (annihilation γ's)*
1.385
1.500*
1.590*
1.785*
Mass assignment from intensity
Observed range E_γ 0.3 to 2.0

H.T.Motz, Phys. Rev. 93, 925A(1954); *verbal report.

Ti^{51}
22 29
5.8^m
γ 0.32 scin

Th. Mayer-Kuckuk, Z. Naturf. 9a, 338 (1954).

No 0.48γ (< 3% of 0.325γ) scin

R.H.Nussbaum, R. van Lieshout, A.H.Wapstra, Phys. Rev. 92, 207 (1953).

V
Capture γ's V(n,γ) scin
0.43
0.64
~0.82 2 unresolved γ's
γ energy range observed 0.1 to 2.0

M.Reier, M.H.Shamos, Phys. Rev. 95, 636A (1954).

V^{47}
23 24
31.1^m
τ 33^m V(187-Mev p)
Assignment confirmed with ms No chem

G.Andersson, Phil. Mag. 45, 621 (1954).

τ 31.1^m Ti(13-Mev d) chem
β^+ 1.90 a
No γ $(E_\gamma/\beta < 0.06$ Mev) a

L.Koester, Z.Naturf. 9a, 104 (1954).

No γ (< 20%) Ti(26-Mev d) chem; a

A.H.W.Aten, Jr., J.Kool, B. de Vries, A.L. Veenendaal, Physica 19, 1051 (1953).

V^{48}
23 25
16.2^d
τ 16.2^d Ti(20-Mev α)

W.H.Burgus, G.A.Cowan, J.W.Hadley, W.Hess, T.Shull, M.L.Stevenson, H.F.York, Phys. Rev. 95, 750 (1954).

V^{48}
23 25
16.2^d

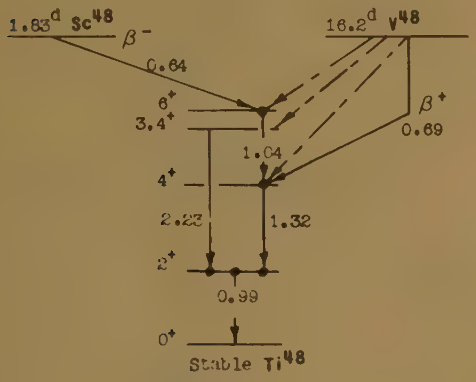
β^+ 0.692 Cr(420-Mev p) chem
No $0.82\beta^+$ (< 0.2%) sl
No > $0.87\beta^+$ (< 0.1%)

L.Marquez, Phys. Rev. 92, 1511 (1953).

$\gamma\gamma(\theta)$ I = 4, 2, 0

D.G.Alkhazov, I.Kh. Lemberg, A.P.Grinberg, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 487 (1953).

$(2.2\gamma)(0.99\gamma)$ Cr(22-Mev d) chem scin
$\gamma\gamma\gamma$ in 10 ± 5 % of disintegrations
$\beta^+/(1.32\gamma) = 0.49 \pm 0.04$ assuming Na^{22} β^+/ϵ = 19



M.Casson, L.S.Goodman, V.E.Krohn, Phys. Rev. 92, 1517 (1953).

V^{50}
23 27
$> 10^{14y}$

I 6 para
$\mu(V^{50})/\mu(V^{51})$ = 0.6501 *14*

C.Kikuchi, M.H.Sirvetz, V.W.Cohen, Phys. Rev. 92, 109(1953); Phys. Rev. 88, 142 (1952).

τ_ϵ $> 1.1 \times 10^{14y}$
No Ti K x ray pc

F.C.Strome, Jr., Dissertation Abstr. 14, 699 (1954).

V^{51}
23 28
stable

Q ~0.3 S

K.Murakawa, T.Kamei, Phys. Rev. 92,325(1953).

$V(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
γ 0.320 scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

V^{52}
23 29
3.77^m

τ 3.77^m V(13-Mev d)
β^- 2.47 a
E_γ/β = 1.5 Mev a

L.Koester, Z.Naturf. 9a, 104 (1954).

V^{52}
23 29
3.77^m

τ 3.77^m Cr(fast n) chem
No low energy ce^- sl
No 2.6^m activity

G.Weber, Z.Naturf. 9a, 115 (1954).

τ 3.75^m V(pile n)
β^- ~2.6 $a\beta\gamma$
γ 1.44 scin
No ce^-
$(2.6\beta)(1.44\gamma)$
No 2.6^m nor 16^h activity found for V^{52}

J.M.LeBlanc, J.M.Cork, S.B.Burson, W.C.Jordan, Phys. Rev. 93, 1124 (1954).

Levels V(d,p) $E_d = 5.74$ S77

93†	g.s.		
36†	0.13	48†	2.13
7†	0.42	33†	2.15
50†	0.78	40†	2.31
75†	0.83	39†	2.42
21†	1.40	10†	2.46
13†	1.48	22†	2.53
100†	1.55	21†	2.85
50†	1.75	20†	3.00
38†	1.79	41†	3.05
20†	1.84	52†	3.19
43†	2.09	29†	3.31

J.E.Schwager, L.A.Cox, Phys. Rev. 92,102(1953).

V^{53}
23 30
23^h

τ 23^h Cr^{53}(pile n) chem
β^- 0.6 a
γ's scin

R.K.Sheline, J.R.Wilkinson, Phys. Rev. 94, 729 (1954).

Cr

$Cr(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

$Cr(n,n'\gamma)$ $E_n = 3.2$
γ 0.75 scin
0.97
1.43 Cf Cr^{52}
(1.43γ)(~1.5-Mev n)
No $(1.43\gamma)\gamma$

P.Shapiro, V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 95, 751 (1954).

Capture γ's $Cr(n,\gamma)$ scin
0.740 1.07
0.815 2.13
γ energy range observed 0.1 to 2.0

M.Reier, M.H.Shamos, Phys. Rev. 95,636A(1954).

Cr Resonance Cr (n) $E_n = 3$ to 10^5 ev
3800 ev $\sigma_0 \Gamma^2 = 8.55 \times 10^7$
time of flight

E. Melkonian, W. W. Havens, Jr., L. J. Rainwater, Phys. Rev. 92, 702 (1953).

Cr^{49}
24 25
41.8^m
β^+ 1.47 Ti (45-Mev α) chem
γ 15† 0.063 $\alpha = 0.14$ M1 sl ce^-,
30† 0.091 $\alpha = 0.06$ M1 scin
14† 0.150 $\alpha = 0.16$ E2
No 0.73 β^+ No 0.61 γ (< 4†) No 1.57 γ

R. M. Nussbaum, A. H. Wapstra, G. J. Nijgh, L. Th. Ornstein, N. F. Verster, Physica 20, 165 (1954); Phys. Rev. 92, 207 (1953).

Cr^{51}
24 27
27^d
No 0.48γ (< 3% of 0.325γ) scin

R. M. Nussbaum, R. van Lieshout, A. H. Wapstra, Phys. Rev. 92, 207 (1953).

Cr^{52}
24 28
stable
Level Cr (n, n'γ) $E_n = 1.4$ to 2.7
γ 1.44 scin
Graph of σ from threshold to 2.7

R. M. Klehn, C. Goodman, Phys. Rev. 95, 989 (1954).

Level Cr (n, n'γ) $E_n = 3.9$
γ 1.43 scin
Assignment from agreement with $5.8^d Mn^{52}$ γ

M. A. Rothman, C. E. Mandeville, Phys. Rev. 93, 796 (1954); 92, 1097A (1953).

Level Cr (n, n'γ) $E_n = 2.5$
γ 1.42 scin
Assignment from agreement with $5.8^d Mn^{52}$ γ

E. A. Elliot, D. Hicks, L. E. Beghian, H. Halban, Phys. Rev. 94, 144 (1954).

Cr^{53}
24 29
stable
I 3/2 Na_2CrO_4 I

K. Halbach, Helv. Phys. Acta 27, 259 (1954).

Cr^{55}
24 31
3.5^m
τ 3.6^m Mn^{55} (15-Mev d) chem
Cr (th n)
β^- ~2.8 a

G. A. Bazorgan, J. W. Irvine, Jr., C. D. Coryell, Phys. Rev. 95, 781 (1954).

Mn^{51}
25 26
45^m
τ 45.2^m Cr (13-Mev d) chem
β^+ 2.16 a
No γ ($E_\gamma/\beta <$ 0.1 Mev) a

L. Koester, Z. Naturf. 9a, 104 (1954).

No γ (< 20%) Cr (8-Mev d) chem; a

A. H. W. Aten, Jr., J. Kool, B. de Vries, A. L. Veenendaal, Physica 19, 1051 (1953).

Mn^{52}
25 27
5.8^d
τ_2 5.60^d Cr (20-Mev d)

W. H. Burgus, G. A. Cowan, J. W. Hadley, W. Hess, T. Shull, M. L. Stevenson, H. F. York, Phys. Rev. 95, 750 (1954).

γ (0.73) $\alpha = 3.0 \times 10^{-4}$ sl
(0.94) $\alpha = 1.8 \times 10^{-4}$
(1.46) $\alpha = 7.2 \times 10^{-5}$

G. L. Keister, Phys. Rev. 96, 855A (1954).

$\beta^+/\epsilon_K = 1.47 \pm 0.03$ (0.511 γ) (0.511 γ) / γ GM

R. Sehr, Z. Phys. 137, 523 (1954).

Mn^{54}
25 29
320^d
τ_2 324^d Fe^{54} (pile n) chem
γ 0.83

G. M. Stafford, L. H. Stein, Nature 172, 1103 (1953)

γ 0.840 ? scin

D. Maeder, A. H. Wapstra, G. J. Nijgh, L. Th. M. Ornstein, Physica 20, 521 (1954).

Mn^{55}
25 30
stable
q ~0.4 S

K. Murakawa, T. Kamei, Phys. Rev. 92, 325 (1953).

Mn^{55} (α, $\alpha'\gamma$) $E_\alpha = 3.0$
γ 0.128 scin

G. M. Temmer, N. P. Heydenburg, Phys. Rev. 93, 351 (1954); 95, 629A (1954).

Mn^{55} (p, p'γ) $E_p = 0.550$ to 2.40
γ 0.133 scin
See also Fe^{55}?

H. Mark, C. McClelland, C. Goodman, Phys. Rev. 95, 628A (1954).

Mn^{56}
25 31
2.58^h
γ (1.8) M1 98% E2 2% $\gamma\gamma(\theta)$
(2.1) M1 92% E2 8%
(1.8γ) (0.85γ) (θ) I = 2, 2, 0
(2.1γ) (0.85γ) (θ) I = 2, 2, 0

F. R. Metzger, W. B. Todd, Phys. Rev. 92, 904 (1953)

(0.845γ) (1.81γ, 2.13γ)
No (1.81γ) (2.13γ)

E. Germagnoli, A. Malvicini, L. Zappa, Nuovo Cim. 10, 1388 (1953).

Mn^{55} (n, γ) $2.58^h Mn$
Activity produced found to decrease when spins of aligned sample are parallel to spins of neutrons in partially polarized beam

S. Bernstein, L. D. Roberts, C. P. Stanford, J. W. T. Dabbs, T. E. Stephenson, Phys. Rev. 94, 1243 (1954).

Mn^{56}
25 31
2.58^h

Capture γ's $Mn^{55}(n,\gamma)$ scin

0.098	0.266
0.206	0.308

γ energy range observed 0.1 to 2.0

M.Reier, M.H.Shamos, Phys. Rev. 95, 636A (1954).

Resonances $Mn^{55}(n)$ $E_n = 0.2$ to 10 kev

E_o (ev)	J	Γ (ev)*	
337	2 ?	22	chopper
1800	3 ?	14	
2360	3	360	

L.M.Bollinger, R.R.Palmer, D.A.Dahlberg, Phys. Rev. 95, 645A (1954); *verbal report.

Resonances $Mn^{55}(n)$ $E_n = 100$ to 1300 ev
350 ev $\sigma_o \Gamma^2 = 3x10^6$ chopper
1120 ev

F.G.P.Seidl, D.J.Hughes, H.Palevsky, J.S.Levin, W.Y.Kato, N.G.Sjöstrand, Phys. Rev. 95, 476 (1954).

Mn^{57}
25 32
1.7^m

τ	1.7^m	Fe^{57} (fast n)	chem
β^-	2.6		scin
γ	0.117		scin
	0.134		
	0.220		
	0.350		
	0.690		

No 7^d activity $\sigma(7^d)/\sigma(1.7^m) < 8 x 10^{-4}$

B.L.Cohen, R.A.Charpie, T.H.Handley, E.L.Olson Phys. Rev. 94, 953 (1954).

Fe

γ Fe(n,n'γ) $E_n = 2.7$ scin

0.462	1.42
0.634	1.59
0.851	1.76
0.989	2.10
1.24	2.66

D.L.Lafferty, L.A.Rayburn, T.M.Hahn, Phys. Rev. 96, 381; 95, 301A, 637A (1954).

γ Fe(n,n'γ) $E_n = 3.3$ scin

0.85	1.44	n'γ
1.29	2.10	Cf Fe^{56}

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 92, 1507 (1953); 91, 441A (1953).

Capture γ's Fe(n,γ) scin
0.355
1.55 to 1.68 2 unresolved γ's
γ energy range observed 0.1 to 2.0

M.Reier, M.H.Shamos, Phys. Rev. 95, 636A(1954).

Fe^{53}
26 27
9^m

γ 30† 0.370 scin
†Percent of β^+

R.H.Nussbaum, R. van Lieshout, A.H.Wapstra, Phys. Rev. 92, 2 07 (1953).

Fe^{55}
26 29
2.9^y

E_{dis} 0.23 scin
From continuous γ endpoint

L.Madansky, F.Rasetti, Phys. Rev. 94,407(1954).

S.E.Singer, W.S.Emmerich, J.D.Kurbatov, Phys. Rev. 94, 113, 779A (1954).

Fe^{55}?
26 29

γ Mn^{55}(p,?γ) $E_p = 2.12$ scin
0.420
0.505
0.650
0.975

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 95, 628A (1954).

Fe^{56}
26 30
stable

Levels Fe(n,n'γ) $E_n = 4.3$ DPl

0.85	2.7
2.1	3.0 ?

B.Jennings, J.B.Weddell, R.L.Hellens, Phys. Rev. 95, 636A (1954).

γ Fe(n,n'γ) $E_n = 3.9$ scin
0.85
1.80
2.15
Assignment from agreement with $2.58^h Mn^{56}$ γ's

M.A.Rothman, C.E.Mandeville, Phys. Rev. 93, 796 (1954); 92, 1097A (1953).

Level Fe(n,n'γ) $E_n = 0.8$ to 2.7
γ 0.85 scin
Graph of σ from threshold to 2.7

R.M.Kiehn. C.Goodman, Phys. Rev. 95,989(1954); 93, 177 (1954).

Level Fe(n,n'γ) $E_n = 2.5$
γ 0.9 scin
Assignment from agreement with 2.58^h Mn^{56} γ

E.A.Eliot, D.Hicks, L.E.Beghian, H.Halban, Phys. Rev. 94, 144 (1954).

Level Fe(γ,γ') $E_\gamma = 0.84$
(0.84) $\tau \gtrsim 8x10^{-12s}$
β recoil of Mn^{56} source in liquid state used to compensate for γ recoil

K.Ilakovac, Proc. Phys. Soc. 67A, 601 (1954).

Fe^{57}
26 31
stable

γ $Fe^{57}(\alpha,\alpha'\gamma)$ $E_\alpha = 1.2$ to 3.2* scin
0.014*
0.122

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 95, 629A (1954); *verbal report.

Resonances Fe(n,n'γ) $E_n = 0.8$ to 2.0
Graph of yield of 0.84 γ scin

R.M.Kiehn, C.Goodman, Phys. Rev. 93, 177 (1954).

Fe^{59}
26 33
45^d

τ	45.0^d 2		Fe(pile n)	chem
Counted for 16 days			differential	ic

J.Tobailem, J. phys. radium 14, 553 (1953).

Co^{55}
27 28
18^h

			Fe(11.5-Mev d)	chem
β^+	2.3†	0.26		sl
	4.9†	0.53		
	39.5†	1.03		
	53.3†	1.500		
			ce^-/β^+ (x10^5)	
γ	2†	0.253		scin
	28†	0.477	11.0	sl ce^-
	156†	0.935	12.4	
	26†	1.41	3.5	
	0.6†	1.84		scin
	4†	2.17		

R.S.Caird, A.C.G.Mitchell, Phys. Rev. 94,412; 93, 916A (1954).

Co^{56}
27 29
77^d

τ	77.2^d	Fe(20-Mev d)

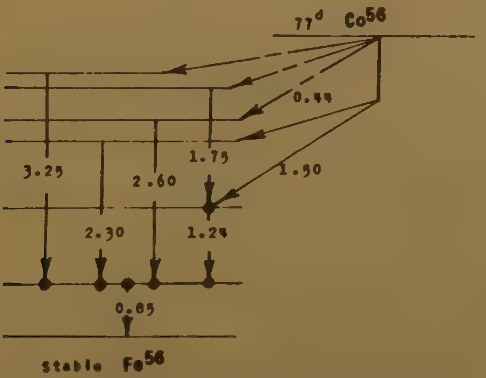
W.H.Burgus, G.A.Cowan, J.W.Hadley, W.Hess, T.Shull, M.L.Stevenson, H.F.York, Phys. Rev. 95, 750 (1954).

γ	0.846	sl pe^-

P.Macq, Ann. Soc. Sci. Bruxelles,67, 309 (1954).

β^+	4†*	0.44		sl
	96†*	1.50	Fe^{56}(10-Mev p)	chem
γ	100†	0.85		scin, sl pe^-
	55†	1.24		
	24†	1.75		
	12†	2.30		
	14†	2.60		
	24†	3.25		

(0.511 γ)(0.85 γ, 1.24 γ)   (1.24 γ)(1.75 γ)
(0.85 γ)(1.24 γ, 1.75 γ,2.30 γ,2.60 γ,3.25 γ)
No (1.24 γ)(2.30 γ,2.60 γ,3.25 γ)
No (0.511 γ)(3.25 γ)
*Percent of all β^+



M.Sakai, J.L.Dick, W.S.Anderson, J.D.Kurbatov, Phys. Rev. 95, 101 (1954); 94, 779A (1954).

Co^{57}
27 30
270^d

			α_K	K/LM	
γ	15†	0.123	0.011	~8	(M)1
	1†	0.138	0.14	~8	(E)2
			Fe(d)	chem	sm/2

D.E.Alburger, M.A.Grace, Proc. Phys. Soc. 67A, 280 (1954).

Co^{59}
27 32
stable

Q	0.5	8

K.Murakawa, T.Kamei, Phys. Rev. 92,325 (1953).

$Co^{59}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

~ 50†	$Co^{59}(\gamma,p)$	$E_\gamma \leq 24$	ppl
< 1†	$Co^{59}(\gamma,d)$		
~ 2†	$Co^{59}(\gamma,\alpha)$		

†In units of 10^4 particles/mole/r
Comparison with yields for Cu (107, 34, and 4 respectively) suggests shell effect for d's
γ,p(θ) consistent with evaporation

M.E.Toms, W.E.Stephens, Phys. Rev. 95, 1209 (1954).

Co^{60}
27 33
5.2^y

$\lvert\mu\rvert$	3.5	$\gamma(\theta,T)$

B.Bleaney, J.M.Daniels, M.A.Grace, H.Halban, N.Kurti, F.N.H.Robinson, F.E.Simon, Proc. Roy. Soc. 221A, 170 (1954).

β^- 0.15%   1.48   log $f_o t = 12.6$ sl
Shape fitted by C_{2T} ($\Delta I = 2$,no) not ($\Delta I = 3$,no)

G.L.Keister, F.H.Schmidt, Phys. Rev. 93,140 (1954).

γ	(1.17)	$\alpha = 1.6 \times 10^{-4}$	sl
	(1.33)	$\alpha = 1.2 \times 10^{-4}$	

G.L.Keister, Phys. Rev. 96, 855A (1954).

γ	(1.17)	$\tau \sim 10^{-11s}$
	(1.33)	$\tau \sim 10^{-11s}$

Z.Bay, V.P.Henri, F.McLernon, Phys. Rev. 94, 780A (1954); verbal report.

γ	(1.33)	$\tau < 7 \times 10^{-10s}$	$\gamma\gamma$

S.Gorodetzky, A.Knipper, R.Armbruster, A. Gallmann, J. phys. radium 14, 550 (1953).

$\gamma\gamma(\theta)$ I = 4, 2, 0   b = 0.16

T.Wiedling, Arkiv Fysik 7, 69 (1954).

Resonance	Co^{59}(n)	E_n = 100 to 180 ev	
	134 ev	σ_o ~9700	chopper
		$\Gamma = 5.2$	J = 3

F.G.P.Seidl, D.J.Hughes, H.Palevsky, J.S.Levin, W.Y.Kato, N.G.Sjöstrand, Phys. Rev. 95, 476; 93, 931A (1954).

Co^{60}
27 33
5.2^y

Capture γ's $Co^{59}(n,\gamma)$ scin

0.237	0.82
0.289	1.48
0.65	1.82

γ energy range observed 0.1 to 2.0

M.Reier, M.H.Shamos, Phys. Rev. 95, 636A (1954).

Co^{62}
27 35
14^m

β^-		2.8		Cu(n)	a
γ	40†	1.0	10†	1.7	scin
	100†	1.17	15†	2.0	
	5†	1.5 ?	3†	2.5 ?	

R.H.Nussbaum, A.H.Wapstra, R. van Lieshout, G.J.Nijgh, L.Th.M.Ornstein, Physica 20, 571 (1954).

Ni

$Ni(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$

No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

$Ni^{58?}$
28 30
stable

Level $Ni(n,n'\gamma)$ $E_n = 1.3$ to 2.7
γ 1.47   scin
Graph of σ from threshold to 2.7

R.M.Klehn, C.Goodman, Phys. Rev. 95, 989(1954).

Ni^{59}
28 31
$7.5 \times 10^{+y}$

E_{dis} 1.07   scin
From continuous γ endpoint
No 0.511 γ ($< 4 \times 10^{-3}$%)

S.E.Singer, W.S.Emmerich, J.D.Kurbatov, Phys. Rev. 94, 113, 779A (1954).

Levels $Ni^{58}(d,p)$ $E_d = 3.03$ ppl

	I*	d,p(θ)
g.s.	3/2−	
~0.3	7/2− ?	
~0.7		
~1.2	7/2− ?	
~1.6	1/2−	

*From Wolfenstein compound nucleus theory. Stripping not evident.

W.W.Pratt, Phys. Rev. 95, 1517 (1954); 94, 1086 (1954).

Ni^{60}
28 32
stable

Level $Ni(n,n'\gamma)$ $E_n = 1.3$ to 2.7
γ 1.33   scin
Graph of σ from threshold to 2.7

R.M.Klehn, C.Goodman, Phys. Rev. 95,989(1954).

$Ni(n,n'\gamma)$ $E_n = 3.9$
γ 0.90?   scin
1.36
Assignment from agreement with Cu^{60} γ's q.v.

M.A.Rothman, C.E.Mandeville, Phys. Rev. 93, 796 (1954).

Ni^{61}
28 33
stable

$Ni^{60}(d,p)$ $E_d = 3.03$ ppl
p group (double ?) with Q = 5.55 found with both enriched Ni^{58} and Ni^{60}. No higher energy group with Ni^{60}.

W.W.Pratt, Phys. Rev. 95, 1517 (1954); 94, 1086 (1954).

Ni^{63}
28 35
85^y

β^- 0.062   ΔI = 2, yes shape   EA

Y.Kobayashi, G.Miyamoto, S.Mori, J. Phys. Soc. Japan 8, 684 (1953).

Cu

$Cu(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

$Cu(n,n'\gamma)$ $E_n = 2.8$
γ 1.67 ?   scin
2.42 ?

L.A.Rayburn, D.L.Lafferty, T.M.Hahn, Phys. Rev. 94, 1641 (1954); 95, 301A, 637A (1954).

$Cu(n,n'\gamma)$ $E_n = 3.3$
γ 2.19   n'γ scin

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 92, 1507 (1953); 91, 441A (1953).

Capture γ's $Cu(n,\gamma)$ scin
0.202
0.280
γ energy range observed 0.1 to 2.0

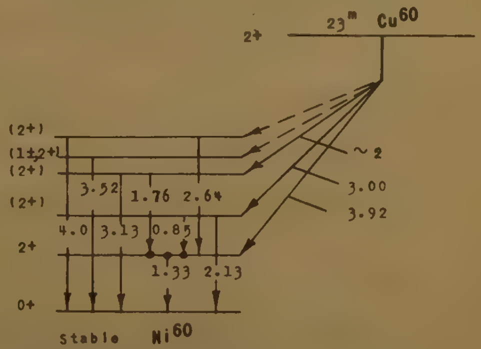
M.Reier, M.H.Shamos, Phys. Rev. 95,636A(1954).

Cu^{60}
29 31
23^m

τ 23.4^m 2   Ni(26-Mev d)

β^+	69†	2.00	composite of 3 β^+'s?		sl
	18†	3.00			
	6†	3.92			
	15†	0.85	5.5†	2.64	scin
	80†	(1.332)	3.7†	3.13	
	52†	1.76	2.0†	3.52	
	5.7†	2.13	1.1†	4.0	

No 1.17 γ (< 1%) No (0.85 γ)(1.76 γ)
(0.85 γ)(1.33 γ) (1.33 γ)(1.76 γ)
$\overline{E}_\gamma$ in coincidence with β^+ is 2.5 ± 0.3



R.H.Nussbaum, R. van Lieshout, A.H.Wapstra, N.F.Verster, F.E.L.Ten Hauf, G.J.Nijgh, L.Th.M.Ornstein, Physica 20,555(1954); Phys. Rev. 93, 255 (1954).

Cu^{62}
29 33
10^m

τ 10.1^m *2* d 9.3^hZn chem
β^+ 2.91 sl
No γ with $E_\gamma > 0.35$ (< 5% of β^+) scin

R.H.Nussbaum, A.H.Wapstra, R. van Lieshout, G.J.Nijgh, L.Th.M.Ornstein, Physica 20, 571 (1954).

Cu^{63}
29 34
stable

Q −0.13 S

H.Kopfermann, A.Steudel, S.Wagner, W.Walcher, Nachr. Akad. Wiss. Göttingen, Math-physik. Kl. IIa, No. 1 (1953).

Level Cu(γ,γ') E_γ = 0.96
(0.96) $\tau \sim 6\times10^{-13}$s
β recoil of Zn^{63} source in liquid state used to compensate for γ recoil

K.Ilakovac, Proc. Phys. Soc. 67A, 601 (1954).

Levels Cu(n,n'γ) E_n = 2.8
γ 0.96 scin
1.91
2.58 ?
Assignment from agreement with $38^m Zn^{63}$ γ's

L.A.Rayburn, D.L.Lafferty, T.M.Hahn, Phys. Rev. 94, 1641 (1954); 95, 301A, 637A (1954).

Level Cu(n,n'γ) E_n = 3.3
γ 0.9 ? n'γ scin
Assignment from agreement with $38^m Zn^{63}$ γ

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 92, 1507 (1953); 91, 441A (1953).

Level Cu(n,n'γ) E_n = 3.8
γ ~0.9 scin

M.A.Rothman, H.S.Hans, C.E.Mandeville, Phys. Rev. 94, 791A (1954).

Cu^{64}
29 35
12.8^h

I 1 M
$|\mu|$ 0.40

A.Lemonick, F.M.Pipkin, Phys. Rev. 95, 1356 (1954).

γ 1.35 s pe$^-$
γ/β^+ = 0.042

B.S.Dzhelepov, N.N.Zhuckovskii, V.P.Prikhodtseva, Yu. V.Khol'nov, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 511 (1953); Chem. Abstr. 48-2488d (1954).

Cu^{65}
29 36
stable

Level Cu(n,n'γ) E_n = 2.8
γ 1.11 scin
Assignment from agreement with $2.56^h Ni^{65}$ γ

L.A.Rayburn, D.L.Lafferty, T.M.Hahn, Phys. Rev. 94, 1641 (1954); 95, 301A, 637A (1954).

Levels Cu(n,n'γ) E_n = 3.3
γ 1.13 n'γ scin
1.53
Assignment from agreement with $2.56^h Ni^{65}$ γ's

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 92, 1507 (1953); 91, 441A (1953).

Cu^{66}
29 37
5.10^m

τ 5.20^m Cu(13-Mev d)
β^- 90% 2.60 a
E_γ/β = 0.10 Mev a

L.Koester, Z.Naturf. 9a, 104 (1954).

Zn^{62}
30 32
9.3^h

τ 9.3^h *2* Cu(d)
γ 36% 0.0413 *3* $\alpha_K = 0.52$ sl, scin
K/LM = 8.0 M1
$(0.0413\ \gamma)/\beta^+(Zn^{62} + Cu^{62}) = 0.195$
$[ce^-_K(0.0413\ \gamma)]/\beta^+(Zn^{62} + Cu^{62}) = 0.101$

R.H.Nussbaum, A.H.Wapstra, R. van Lieshout, G.J.Nijgh, L.Th.M.Ornstein, Physica 20, 571 (1954).

Zn^{65}
30 35
245^d

τ 245.0^d *8* Zn(pile n) chem
Counted for 60 days differential ic

J.Toballem, J. phys. radium 14, 553(1953).

β^+ 1.7% 0.325 FK plot linear to 0.05
γ 44.1% (1.11) $\alpha = 2.6\times10^{-4}$ E2 sl
K/LM <10
ϵ_{gs} 54.2%
$e_A : \beta^+ : ce^-$ = 10,300 : 361 : 2.36

J.F.Perkins, S.K.Haynes, Phys. Rev. 92, 687, 1096A(1953).

β^+ 2.0% (0.325) $(0.511\ \gamma)/(1.11\ \gamma)$ GM
γ 47.5% (1.11) x γ/x
ϵ_{gs} 50.5%

R.Sehr, Z. Phys. 137, 523 (1954).

γ (1.11) $\alpha = 2.2\times10^{-4}$ sl Cpt

E.F.Sturcken, Z.O'Friel, A.H.Weber, Phys. Rev. 93, 1053 (1954).

β^+ 0.327 Cu(d,2n) chem; sl
γ (1.11) $\alpha = 1.8\times10^{-4}$
No 0.20γ ($< 3\times10^{-4}$)
$\gamma/\beta^+ = 28 \pm 7$
$\epsilon_{gs}/\beta^+ = 34 \pm 7$(calc) thus $\Delta L = 0$ transition

R.Bouchez, P.Hubert, N.Perrin, M.Sakai, J. phys. radium 14, 29A; 14,273(1953); Compt. rend. 236, 1249 (1953).

β^+ 0.320 sm
$\gamma/\beta^+ = 24 \pm 1$ Na^{22}comparison(ϵ = 10%) scin

T.Yuasa, Compt. rend. 237, 1077 (1953).

β^+ 0.325 s
γ 1.122 $\alpha = 1.7\times10^{-4}$ s ce$^-$
$\gamma/\beta^+ = 33 \pm 3$ s pe$^-$

A.A.Bashilov, N.M.Anton'eva, D.C.Broder, B.S.Dzhelepov, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 468 (1953); Chem. Abstr. 48-2488h (1954).

Zn^{65}
30 35
245^d

$\gamma/\beta^+ = 31 \pm 5$ scin

D.Maeder, R.Müller, V.Wintersteiger, Helv. Phys. Acta 27, 3 (1954).

Level Cu(p,n) $E_p = 2$ to 4
0.86
"Threshold" neutrons detected

C.F.Cook, T.W.Bonner, Phys. Rev. 94,807A(1954).

Resonances Zn^{64}(n) $E_n = 0.15$ to 10 kev

E_o (ev)	Γ (ev)*	σ_o*	chopper
2750	75	945	
4600	~60	565	

D.A.Dahlberg, L.M.Bollinger, Phys. Rev. 95, 645A (1954); *verbal report.

Zn^{67}
30 37
stable

Zn($\alpha,\alpha'\gamma$) $E_\alpha = 3.0$
γ 0.093 scin
0.182

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Zn^{66}(n) $E_n = 0.15$ to 10 kev
No resonances observed

D.A.Dahlberg, L.M.Bollinger, Phys. Rev. 95, 645A (1954).

Zn^{68}
30 38
stable

Resonances Zn^{67}(n) $E_n = 0.15$ to 10 kev

E_o(ev)	Γ (ev)*	σ_o*	chopper
225	1.5	4350	
455	13	2860	
1620	~20	804	
2300	~30	565	

D.A.Dahlberg, L.M.Bollinger, Phys. Rev. 95, 645A (1954); *verbal report.

Zn^{69}
30 39
14^h

γ 0.439 $\alpha_K = 0.040$ M4 s
K/LM = 7.5

V.M.Dolishnyuk, G.M.Drabkin, V.I.Orlov, L.I.Rusinov, Doklady Akad. Nauk SSSR 92, 1141 (1953); NSF-tr-229

Zn^{69}
30 39
52^m

β^- 0.92 d 14^hZn s

V.M.Dolishnyuk, G.M.Drabkin, V.I.Orlov, L.I.Rusinov, Doklady Akad. Nauk SSSR 92, 1141 (1953); NSF-tr-229.

Levels Zn^{68}(d,p)
g.s. $l_n = 1$ d,p(θ)
(0.439) $l_n = 4$

F.S.Eby, R.D.Hill, W.K.Jenschke, Phys. Rev. 93, 925A (1954).

Resonance Zn^{68}(n) $E_n = 0.15$ to 10 kev
530 ev $\Gamma = 10$ ev chopper
$\sigma_o = 4910$*

D.A.Dahlberg, L.M.Bollinger, Phys. Rev. 95, 645A (1954); *verbal report.

Zn^{71}
30 41
3^h

τ_1 3^h Zn^{70}(pile n)
β^- 1.5 a$\beta\gamma$
γ 0.38 scin
0.49
0.61
(1.5 β) (0.38 γ, 0.49 γ, 0.61 γ)
(0.38 γ) (0.49 γ, 0.61 γ), (0.49 γ) (0.61 γ)

J.M.LeBlanc, J.M.Cork, S.B.Burson, Phys. Rev. 94, 1436A (1954).

Zn^{71}
30 41
2.2^m

τ_2 2.2^m Zn^{70}(pile n)
β^- 2.4 a
γ w 0.12 scin
0.51
w 0.90
w 1.05
(2.4 β) (0.51 γ)
No (0.51 γ) (0.12 γ)

J.M.LeBlanc, J.M.Cork, S.B.Burson, Phys. Rev. 94, 1436A (1954).

Ga

Relative abundances

A	69	71
%	60.5	39.5

S.Antkiw, V.H.Dibeler, J. Chem. Phys. 21, 1890 (1953).

Ga($\alpha,\alpha'\gamma$) $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Resonances Ga(n) $E_n = 0.8$ to 10^5 ev
time of flight

E_o (ev)	$\sigma_o\Gamma^2$
102	2,200
310	170,000
500?	
1000?	

E.Melkonian, W.W.Havens, Jr., L.J.Rainwater, Phys. Rev. 92, 702 (1953).

Ga^{65}
31 34
15^m

τ_1 15^m Cu(α) chem
γ IT? 0.052 α large sl ce⁻, scin
0.092
0.114

B.Crasemann, Phys. Rev. 93, 1034 (1954).

τ_1 15^m Zn(13-Mev d) chem
β^+ 2.1 a
No γ ($E_\gamma/\beta < 0.3$ Mev) a
[β^+ in 8^m Ga^{65} ?]

L.Koester, Z.Naturf. 9a, 104 (1954).

Ga^{65}
31 34
8^{m}

τ_2 8.0^{m} Cu(α), Zn(d) chem
not Zn(p)
β^+ s
No γ sl ce^- pe^-, scin

B.Crasemann, Phys. Rev. 93, 1034 (1954).

Ga^{66}
31 35
9.4^{h}

γ	2†	0.83	22†	2.75	scin
	30†	1.04	2†	3.24	
	3†	1.37	3†	3.41	
		1.58 ?	2†	3.78	
	4†	1.93	2†	4.12	
	6†	2.18	5†	4.33	
	2†	2.40	2†	4.83	

(<0.5β) (1.04, 1.37, 2.18, 2.75, 3.24, 3.41 γ's)
(<0.5β) (2.40, 3.78γ's)?
(>1.0β) (1.04, 1.37, 2.40?, 2.75 γ's)
(>2.2γ) (1.04, 1.58 γ's)
†Photons per 100 disintegrations assuming 40%ε

L.G.Mann, W.E.Meyerhof, H.I.West, Jr., Phys. Rev. 92, 1481 (1953).

Ga^{67}
31 36
78^{h}

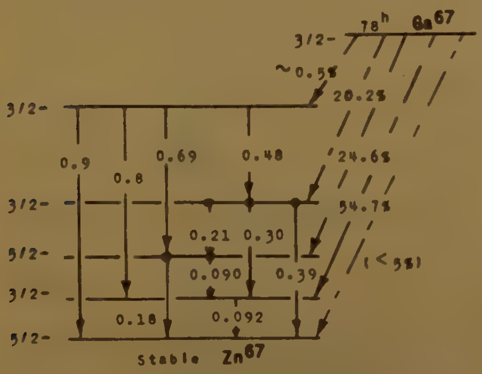
γ	100†	(0.090) (0.092)	scin
	55†	(0.182) (0.21)	
	39†	(0.30)	
	5†	(0.39)	

D.Maeder, R.Müller, V.Wintersteiger, Helv. Phys. Acta 27, 3 (1954).

No β^+ (< 0.01%)

γ	7†	0.090			scin
	93†	0.092	α = 0.54	τ = 9.5$^{\mu s}$	
	44†	0.182	~0.2†	0.48	
	3†	0.21	~0.1†	0.69	
	28†	0.30	~0.2†	~0.8	
	10†	0.39	~0.6†	~0.9	

(0.69γ) (0.18γ) (0.21γ) (0.18γ)
(0.48γ) (0.39γ, 0.30γ, 0.18γ, 0.21γ)
0.09γ, 0.21γ, 0.30γ preceed 0.092γ
No γ follows 0.092γ
(0.21γ) (0.18γ) (θ) I = 3/2, 5/2, 5/2



W.E.Meyerhof, L.G.Mann, H.I.West, Jr., Phys. Rev. 92, 758 (1953).

Ga^{68}
31 37
68^{m}

τ 68^{m} Zn(13-Mev d) chem
β^+ 1.90 a
No γ ($E_\gamma/\beta < 0.1$ Mev) a

L.Koester, Z.Naturf. 9a, 104 (1954).

Ga^{69}
31 38
stable

q(Ga^{69})/q(Ga^{71}) = 1.5867 *4* $\mathrm{GaCl_3}$ quad res

H.G.Dehmelt, Phys. Rev. 92, 1240 (1953).

Ga^{70}
31 39
21.4^{m}

τ 21.37^{m} Ga^{69}(th n)
β^- 0.3% ~0.4 scinβγ
0.5% ~0.6
γ 0.174 scin
1.036
(0.174γ)(1.04γ)(θ) I = 0, 2, 0
No 1.21 γ (< 2% of 0.174γ)
(~0.4β)(0.174γ) (~0.6β)(1.04γ)

M.E.Bunker, J.W.Starner, J.P.Mize, Phys. Rev. 95, 612A (1954); verbal report.

Ge^{67}
32 35
20^{m}

τ 19^{m} Zn(52-Mev α) chem
β^+ 3.4 a
γ 0.17 scin

A.H.W.Aten, Jr., T. de Vries-Hamerling, L. Lindner, Physica 19, 1046 (1953).

Ge^{71} ?
32 39
~14^{d}

τ ~14^{d} Ge(pile n); chem
Ga K x ray crit a
One month after irradiation continuous γ end point of 0.16 observed in addition to 0.226 end point of 11.4^{d} Ge^{71}

M.Langevin, Compt. rend. 238, 2518 (1954).

Ge^{71}
32 39
11.4^{d}

E_{dis} 0.237 *5* scin
From continuous γ endpoint Ge(pile n), chem

M.Langevin, Compt. rend. 238, 2518 (1954).

Intensity of low energy γ's in continuous γ spectrum is higher than that predicted for capture of $l = 0$ electrons. See theory which includes capture of $l = 1$ electrons [Phys. Rev. 95, 572 (1954)].

B.Saraf, Phys. Rev. 95, 97, 612A (1954).

Ge^{73}
32 41
stable

μ -0.8768 *1* $\mathrm{GeCl_4}$ I
ν(Ge^{73})/ν(D) = 0.22725 *3*

C.D.Jeffries, Phys. Rev. 92, 1262 (1953).

|μ| 0.87677 *9* $\mathrm{GeCl_4}$ I
ν(Ge^{73})/ν(D) = 0.22724 *2*

S.I.Aksenov, K.V.Vladimirskii, Doklady Akad. Nauk SSSR 96, 37 (1954); NSA 8-5343 (1954).

Ge^{73}
32 41
stable

$Ge^{73}(\alpha,\alpha'\gamma)$ $E_\alpha = 1.0$ to 3.2^*

γ 0.068 scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 351 (1954); 95, 629A (1954); *verbal report.

Ge^{75}
32 43
49^s

τ_1	49^s		Ge^{74}(pile n)	
γ	0.139	K/L > 3	s ce^-, scin	
No β^-				

S.B.Burson, W.C.Jordan, J.M.LeBlanc, Phys. Rev. 95, 613A (1954).

Ge^{75}
32 43
82^m

γ	~2.2†*	(0.067)	<0.03†*	(0.405)	scin
	<0.15†*	(0.138)	2.5†	0.427*	
	12†*	(0.203)	2.3†	0.48 *	
	100†	(0.269)	1.8†	0.628*	

$(0.427\gamma, 0.067\gamma)(0.203\gamma)^*$ No other $\gamma\gamma$
$(\sim 0.88\beta)(0.269\gamma)$

A.W.Schardt, J.P.Welker, Phys. Rev. 93, 916A (1954); *verbal report.

Ge^{77}
32 45
52^s

τ_1		52^S	Ge^{76}(pile n)
β^-		2.7	a
γ	~100†	0.159	scin
	~100†	0.215	

$(2.7\ \beta)(0.215\ \gamma)$ no $\gamma\gamma$ no $\beta(0.159\ \gamma)$

S.B.Burson, W.C.Jordan, J.M.LeBlanc, Phys. Rev. 95, 613A (1954).

Ge^{77}
32 45
12^h

$(0.210\ \gamma)(0.265\ \gamma)$ $(0.215\ \gamma)(0.410\ \gamma)$

S.B.Burson, W.C.Jordan, J.M.LeBlanc, Phys. Rev. 95, 613A (1954); verbal report.

As^{73}
33 40
76^d

γ (0.0135) $\alpha \geq 1300$ $\tau = 4.6^{\mu s}$
(0.0539) $\alpha = 4.7$ $\tau = 0.33^{s*}$

0.0135γ follows 0.054γ scin
No 0.081γ (< 0.2% of 0.054γ) No 0.0674γ
All ϵ to 0.0674 level

J.P.Welker, A.W.Schardt, G.Friedlander, J.J. Howland, Jr., Phys. Rev. 92, 401 (1953); 91, 484A (1953). *E.C.Campbell, ibid.

γ (0.0539) $\alpha \sim 8$ scin, pc

R.Barloutaud, R.Ballini, M.Sartori, Compt. rend. 237, 886 (1953).

As^{75}
33 42
stable

$As^{75}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$

γ	0.068	scin
	0.199	
	0.283	

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

As^{76}
33 43
26.5^h

τ		26.4^h	As^{75}(pile n)	chem
β^-	3%	0.35		sl
	6%	1.20		
	6%	1.75		
	32%	2.40		
	53%	2.96	$\Delta I = 2$, yes shape	
γ	100†	0.555		sl pe^-
	9†	0.648		
	23†	1.210		
	1.5†	1.410		
	5†	2.06		

P. Hubert, Ann. Phys. 8, 662 (1953).

β^+	0.67	s
$\beta^+/\beta^- \sim 10^{-3}$		cc

B.B.Murray, J.D.Kurbatov, Phys. Rev. 94, 780A (1954).

γ	100†	0.549	sl pe^-
	22†	0.643	scin
	27†	1.200	
	2†	1.40	
	5†	2.05	

No 1.7–1.8 γ's

M.Sakai, B.Murray, J.D.Kurbatov, Phys. Rev. 96, 862A (1954).

γ (0.55) E2
$(2.41\beta)(0.55\gamma)$ polarization-direction

D.R.Hamilton, A.Lemonick, F.M.Pipkin, Phys. Rev. 92, 1191 (1953); 90, 370A (1953).

Capture γ's $As^{75}(n,\gamma)$ s pr

2†	4.53	1†	6.05
1†	4.77	2†	6.38
1†	4.97	2†	6.85
2†	5.17	2†	7.05
1†	5.41	0.5†	7.30

Also graph $E_\gamma = 2.5$ to 8
†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025 (1953).

As^{77}
33 44
38.7^h

τ 39.0^h Br($\leq$31-Mev γ)

P.Erdös, P.Jordan, J.Schmouker, P.Stoll, Helv. Phys. Acta 27, 187A (1954).

Se

Capture γ's Se(n,γ) s pr

2.0†	4.57	2.3†	6.02
0.7†	5.21	1.2†	6.23
2.1†	5.59	0.9†	6.41
1.4†	5.80		

Also graph $E_\gamma = 3.5$ to 10.6
See also Se^{77} and Se^{78}
†Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

$Se^{73?}$
34 39
44^m

τ 44^m Ge(33-Mev α) chem
β^+ 1.7 a
Not p 52^mAs (< 0.1%)
$\sigma(7^h Se)/\sigma(44^m Se) \sim 5$ $E_\alpha = 33$ to 52

F.N.Hooge, A.H.W.Aten, Jr., Physica 19, 1047 (1953).

Se^{75}
34 41
127^d

I 5/2 $OCSe^{75}$ M
q +0.9

L.C.Aamodt, P.C.Fletcher, G.Silvey, C.H.Townes, Phys. Rev. 94, 789A (1954).

γ ~1† (0.067) ~0.2† (0.203) scin
~4† (0.098) 100† { (0.269) (0.281) }
84† { (0.124) (0.138) } 17† (0.405)
$(0.067\gamma)(0.138\gamma, 0.203\gamma)$ $(0.124\gamma)(0.281\gamma)$
$(0.138\gamma)(0.269\gamma)$ No $(0.405\gamma)(\gamma)$

A.W.Schardt, J.P.Welker, Phys. Rev. 93, 916A, 910 (1954).

Se^{77}
34 43
stable

I 1/2 $(Se^{77})_2$ B

S.P.Davis, Phys. Rev. 93, 159 (1954).

$Se^{77}(\alpha, \alpha'\gamma)$ $E_\alpha = 3.0$
γ 0.237 scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954); priv. comm.

Capture γ's Se(n,γ) s pr
3.6† 6.586
0.3† 6.88 ?
1.8† 7.185
2.2† 7.416
Above γ's fit Se^{77} levels known from Br^{77} decay. See also Se
†Photons per 100 n captures in Se

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

Se^{78}
34 44
stable

I 0 $(Se^{78})_2$ B

S.P.Davis, Phys. Rev. 93, 159 (1954).

Capture γ's Se(n,γ) s pr
0.7† 7.73 0.7† 9.172
0.1† 7.95 1.0† 9.882
0.5† 8.092 0.08† 10.483
0.2† 8.50
>7.3 γ's assigned to Se^{78} from intensities and known mass ratio
†Photons per 100 n captures in Se

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

Se^{79}
34 45
6.5×10^{4y}

I 7/2 Mic
μ -1.015
q 0.7

W.A.Hardy, G.Silvey, C.H.Townes, B.F.Burke, M.W.P.Strandberg, G.W.Parker, V.W.Cohen, Phys. Rev. 92, 1532 (1953); 85,494 (1952).

Se^{79}
34 45
6.5×10^{4y}

q +0.9 Mic
Calculated from data of Hardy et al., Phys. Rev. 85, 494 (1952).

G.R.Bird, C.H.Townes, Phys. Rev. 94, 1203 (1954).

Se^{80}
34 46
stable

I 0 $(Se^{80})_2$ B

S.P.Davis, Phys. Rev. 93, 159 (1954).

Br

Br$(\alpha, \alpha'\gamma)$ $E_\alpha = 3.0$
γ 0.044 scin
0.213
0.266

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

Br^{74}
35 39
36^m

τ 36^m Cu^{65}(90-Mev C) chem
Mass assignment based on yields in $Cu^{65}(C, xn)$ and $Cu^{63}(C, xn)$ reactions not p $7.1^h Se^{73}$

J.M.Hollander, Phys. Rev. 92, 518 (1953).

Br^{77}
35 42
58^h

$\beta^+/\epsilon_K(g.s.) = 0.025$
$\epsilon_K(g.s.)/\epsilon_K(total) = 0.38$ $x\gamma/x$ GM
No $\beta^+\gamma$

R.Sehr, Z. Phys. 137, 523 (1954).

Br^{79}
35 44
stable

$\mu(Br^{81})/\mu(Br^{79}) = 1.07794$ M
q +0.33
$q(Br^{79})/q(Br^{81}) = 1.19707$

J.G.King, V.Jaccarino, Phys. Rev. 94, 1610 (1954); 91, 209A (1953).

$Br^{80?}$
35 45
5.1^s

τ_1 5.1^{s*} Br^{79}(pile n)
γ 0.21 scin

G.Scharff-Goldhaber, M.McKeown, Phys. Rev. 95, 613A (1954); *verbal report.

Br^{80}
35 45
18.5^m

β^- ~15†* (1.42) Br(slow n)chem; sl
85†* 2.04*
β^+ 4† 0.862
γ 12† 0.62 scin

L.Lidofsky, R.Gold, C.S.Wu, Phys. Rev. 94,780A (1954); * verbal report.

β^- ~15† 1.38 Br^{79}(pile n); sl $\beta\gamma$
~85† 2.0 sl
$(1.38\ \beta)(0.62\ \gamma)$

J.Laberrigue-Frolow, N.Marty, J. phys. radium 15, 584 (1954).

γ 0.62 Br^{79}(pile n) scin

J.Laberrigue-Frolow, M.Langevin, R.Bernas, Compt. rend. 238, 677 (1954).

Br^{81}
35 46
stable

q +0.28 M

J.G.King, V.Jaccarino, Phys. Rev. 94, 1610 (1954); 91, 209A (1953).

Br^{82}
35 47
35.7^h

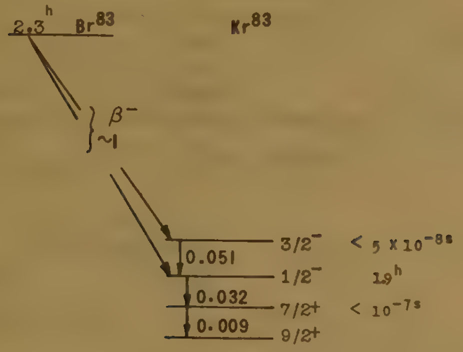
γ "sum" peaks scin
1.16 2.10
1.31 2.62
1.85

"Sum" peaks are those produced or enhanced by placing sample inside 2" crystal

D.C.Lu, W.H.Kelly, M.L.Wiedenbeck, Phys. Rev. 95, 1533 (1954).

Br^{83}
35 48
2.3^h

τ 2.30^h *5* Se(10-Mev d) chem
γ 0.051 $K/L > 8$ M1 $a\beta e^-$
$\tau < 5 \times 10^{-8s}$ $\beta\gamma$
$e^-/\beta = 0.12$ cc



P.Swinbank, J.Walker, Proc. Phys. Soc. 66A, 1093 (1953).

Kr^{76}
36 40
9.7^h

τ 9.7^h Y^{89}(150-Mev p) chem
No β^+ with $E_{\beta+} > 0.6$ p 17^hBr a
No x ray pc

A.A.Caretto, Jr., E.O.Wiig, Phys. Rev. 93,175 (1954).

Kr^{79}
36 43
34.5^h

γ (0.044) $\tau < 3^{\mu s}$ $e_A ce^-$ pc
$(ce^-\ 0.044\gamma)/(e_A(K)) \sim 0.007$
$e_A(L)/e_A(K) = 1.66$
$\epsilon_L/\epsilon_K = 0.10$ or 0.25 (0.10 theory) for fluorescence yield 0.63* or 0.57** resp.

M.Langevin, P.Radvanyi, Compt. rend. 238,77, 232(1954); *Broyles, Thomas, Haynes, Phys. Rev. 89,723(1953); **Burhop, The Auger Effect, Camb. Univ. Press p. 48(1952).

Kr^{83}
36 47
stable

μ +0.96706 *4* I

E.Brun, J.Oeser, H.H.Staub, C.G.Telschow, Helv. Phys. Acta 27, 173A (1954).

Kr^{85}
36 49
4.4^h

γ (0.150) $\alpha_K = 0.040$ sl
(0.305) $\alpha_K = 0.41$ M4
$(ce^-_K\ 0.305\ \gamma)/(ce^-_K\ 0.150\ \gamma) = 1.8$ sl
$(0.150\ \gamma)/(0.305\ \gamma) = 5.7$ scin

I.Bergström, S.Thulin, A.H.Wapstra, B.Aström, Arkiv Fysik 7, 255 (1954).

Kr^{85}
36 49
10.3^y

τ 10.57^y *0.14*
Counted 0.33-Mev β's in sl for nine months

J.F.Turner, AERE N/R 1254 (1953).

Kr^{85}
36 49
10.3^y

Levels Kr^{84}(d,p) $E_d = 3.80$ a
0.29 2.21*
1.60* 2.94*
*Or 1.18,1.79,2.52 levels in Kr^{87}

G.W.Wheeler, R.B.Schwartz, W.W.Watson, Phys. Rev. 92, 121 (1953).

Kr^{87}
36 51
78^m

Levels Kr^{86}(d,p) $E_d = 3.80$ a
0.52
1.17*
2.01*
*Or 1.59, 2.43 levels in Kr^{85}.

G.W.Wheeler, R.B.Schwartz, W.W.Watson, Phys. Rev. 92, 121 (1953).

Rb

Rb($\alpha,\alpha'\gamma$) $E_\alpha = 3.0$
γ 0.150 scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

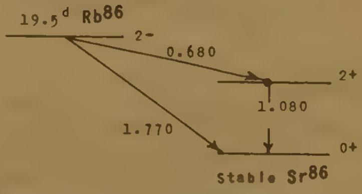
Rb^{82}
37 45
1.25^m

τ_1 1.25^m d 26^dSr chem
β^+ (3.15) a
No γ with $E_\gamma > 0.6$
Not p 6.3^hRb (< 0.1%)

L.M.Litz, S.A.Ring, W.R.Balkwell, Phys. Rev. 92, 288 (1953).

Rb^{86}
37 49
19.5^d

β^- ~12% 0.680 sl $\beta\gamma$
~88% 1.770 $\Delta I = 2$, yes shape sl
γ 1.080 sl pe^-



A.V.Pohm, W.E.Lewis, J.H.Talboy, E.N.Jensen, Phys. Rev. 95, 1523 (1954).

β^- 0.72 sl
1.760 $\Delta I = 2$, yes shape
γ 1.055 $\tau < 10^{-9s}$ sl pe^-
$\beta\gamma(\theta)$ b = 0.14

P.Macq, Ann. Soc. Sci. Bruxelles 67,309(1954).

γ 8.9 ± 0.5% 1.08 scin, ic
No other γ found 4π scin

W.S.Lyon, J.E.Strain, Phys. Rev. 95, 1500 (1954).

γ (1.08) E2
$(0.72\beta)(1.08\gamma)$ polarization-direction

D.R.Hamilton, A.Lemonick, F.M.Pipkin, Phys. Rev. 92, 1191(1953); 90, 370A(1953).

Rb^{86}
37 49
19.5^d

Resonance Rb(pile n)$19.5^d Rb$
$\sim$970 ev B absorption

H.W.Newson, R.H.Rohrer, Phys. Rev. 94, 654 (1954); 87, 177A (1952).

Rb^{87}
37 50
6.2×10^{10y}

τ 6.2×10^{10y} 89.62% Rb^{87}
β^- 0.275 sl
Shape fitted by C_{3T} with $\rho = 2.37$
$\rho = Q_3(\beta a, r)/Q_3(\beta\sigma \times r, r)$

M.H.MacGregor, M.L.Wiedenbeck, Phys. Rev. 94, 138 (1954).

τ $6.1\times10^{10y*}$
β^- 0.25 a
Excess of e^- ($E_{e^-} \leq 0.012$) assumed to be β's a
No γ with $E_\gamma \geq 0.1$
No K x ray, L x ray No βe^-
*Based on 27.5% abundance

J.Flinta, S.Eklund, Arkiv Fysik 7,401(1954).

Rb^{88}
37 51
17.8^m

Resonance Rb(pile n)$17.8^m Rb$
$\sim$420 ev B absorption

H.W.Newson, R.H.Rohrer, Phys. Rev. 94,654(1954).

Sr

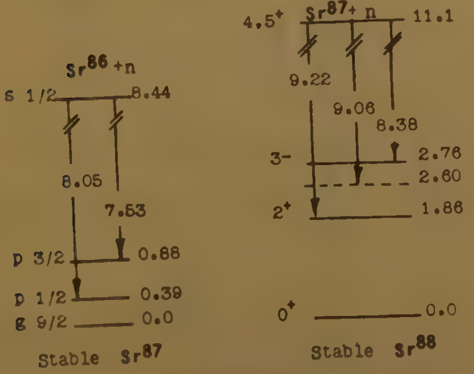
$Sr(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$ scin
No γ

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954); priv. comm.

Capture γ's $Sr(n,\gamma)$ s pr

2†	5.43	5 †	6.95
2†	5.82	5 †	7.53*
4†	6.10	1.1 †	8.05*
5†	6.27	1.3 †	8.38*
6†	6.67	0.1 †	9.06*
6†	6.87	0.06†	9.22*

Also graph $E_\gamma = 2.5$ to 9.5
$B_n(Sr^{86?}) = 8.5$; $B_n(Sr^{87?}) = 11.2$ from γ,n
*See decay scheme for probable assignments
†Photons per 100 n captures



B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

Sr^{82}
38 44
26^d

τ 27^d Zr(190-Mev d) chem
Parent $1.25^m Rb$; not p $6.3^h Rb$ (<0.1%)

L.M.Litz, S.A.Ring, W.R.Balkwell, Phys. Rev. 92, 288 (1953).

Y^{89}
39 50
stable

μ -0.136824 $Y(NO_3)_3$ I
$\nu(Y^{89})/\nu(H) = 0.048994$ 1

E.Brun, J.Oeser, H.H.Staub, C.G.Telschow, Phys. Rev. 93, 172 (1954).

$Y^{89}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 906 (1954).

Y^{90}
39 51
64.6^h

τ 64.6^h 4 U(n,f) chem
Two samples, each counted for 28 days

A.Chetham-Strode Jr., E.M.Kinderman, Phys. Rev. 93, 1029 (1954).

Resonance Y^{89}(pile n)$64.6^h Y$
$\sim$5 kev B absorption

H.W.Newson, R.H.Rohrer, Phys. Rev. 94,654 (1954).

Y^{91}
39 52
57^d

β^- 0.33 $\beta\gamma$ scin
γ 0.3% 1.22 scin
No 0.2 γ (< 0.015%)
(0.33 β)(1.22 γ) No $\gamma\gamma$ U(n,f) chem
1.22 γ follows a 59^d half-life

M.E.Bunker, J.P.Mize, J.W.Starner, Phys. Rev. 94, 1694 (1954).

Zr

$Zr(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ scin
Only 0.093 γ of Hf impurity observed

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Capture γ's $Zr(n,\gamma)$ s pr

16†	6.30
0.5†	7.38
1†	7.71
1†	8.66

Also graph $E_\gamma = 3$ to 9
$B_n(Zr^{90?}) = 7.2$; $B_n(Zr^{91?}) = 8.7$;
$B_n(Zr^{92?}) = 6.6$; from Zr(d,p)
†Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051(1953).

Zr^{88}
40 48
85^d

τ 85^d Nb^{93}(100-Mev p) chem
Counted growth and decay of 106^d Y^{88} 1.85γ
0.26 to 2.9 years after bombardment

E.K.Hyde, Phys. Rev. 92, 927 (1953).

Zr^{89}
40 49
4.3^m

Threshold $Zr(\gamma,n)4.3^mZr^{89}$
12.28
Yield of 79^hZr (expected to have threshold at 11.69) first observed at $E_\gamma = 12.23 \pm 0.06$ presumably because of large spin change required

P.Axel, J.D.Fox, Phys. Rev. 95, 613A (1954); verbal report.

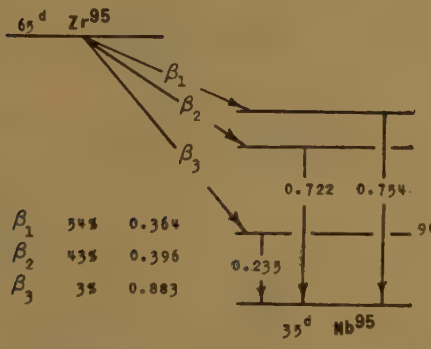
Zr^{91}
40 51
stable

μ -1.3 S

S.Suwa, J. Phys. Soc. Japan 8, 734(1953).

Zr^{95}
40 55
65^d

β^- 54% 0.364 sπ √2
43% 0.396
3% (0.883)
γ 0.722 $\alpha_K = 0.0014$ sπ √2 ce^-
0.754 $\alpha_K = 0.0011$
No $\beta\gamma(\theta)$



P.S.Wittelman, Phys. Rev. 94,99(1954); 91, 484A (1953).

Nb^{89}
41 48
0.8^h

τ_1 0.8^h Nb^{93}(50-Mev p)
p 4.3^mZr chem Zr(40-Mev p) chem

R.M.Diamond, Phys. Rev. 95, 410 (1954).

Nb^{89}
41 48
1.9^h

τ_2 1.9^h Nb^{93}(50-Mev p)
Zr(40-Mev p) chem
β^+ 2.9 a
p 79^hZr chem

R.M.Diamond, Phys. Rev. 95, 410 (1954).

Nb92?
41 51
13^h

τ 13^h Nb^{93}(14-Mev p) chem
γ 2.35 scin
x K x ray a
No β^+ scin
Not p 10^d Nb
$\sigma(10^d\ Nb)/\sigma(13^h\ Nb) \sim 10$ for $E_p = 14$ to 20

R.A.James, Phys. Rev. 93, 288 (1954).

Nb^{93}
41 52
3.7^y

τ_1 $\sim 4^y$ Nb^{93}(pile n) chem
Nb K x rays crit a
e^- 0.0085* pc
0.023*
*Interpreted as K and L ce^- of ~0.027 γ

R.P.Schuman, Phys. Rev. 96, 121 (1954).

Nb^{93}
41 52
stable

$Nb^{93}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Nb^{94}
41 53
2.7×10^{4y}

τ_2 2.7×10^{4y} Nb^{93}(pile n) chem
β^- 0.61 II

M.A.Rollier, E.Saeland, Phys. Rev. 94, 1079 (1954).

Capture γ's $Nb^{93}(n,\gamma)$ s pr
0.8† 5.90
0.8† 5.65
0.4† 7.19
Also graph $E_\gamma = 2.5$ to 7.7
$B_n(Nb^{93}) = 7.3$ from $Nb^{93}(d,p)$
†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025(1953).

Nb^{95}
41 54
90^h

γ 0.220 K/LM = 4.3 s ce^-

V.M.Dolishnyuk, G.M.Drabkin, V.I.Orlov, L.I.Rusinov, Doklady Akad. Nauk SSSR 92, 1141 (1953); NSF-tr-229

Nb^{95}
41 54
35^d

γ (0.77) K/LM = 2.4 sl ce^-
$\alpha = 0.0021$

E.F.Sturcken, Z.O'Friel, A.H.Weber, Phys. Rev. 93, 1053 (1954).

Mo

$Mo(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
γ 0.198 scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Capture γ's Mo(n,γ) s pr
0.7† 6.39 0.2† 7.66
1.1† 6.66 0.1† 7.79
3.1† 6.92 0.5† 8.39*
0.3† 7.40 0.03† 9.15
0.7† 7.54*
Also graph $E_\gamma = 2.7$ to 9.2
*Fit with known Mo^{96} levels if 9.15 γ is Mo^{96} g.s. transition
†Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051(1953).

Mo^{93}
42 51
6.9^h

$(0.26\gamma)(0.69\gamma)(\theta)$ $(0.26\gamma)(1.48\gamma)(\theta)$
$(0.69\gamma)(1.48\gamma)(\theta)$
I = 23/2, 15/2, 11/2, 7/2

J.J.Kraushaar, Phys. Rev. 92, 318 (1953).

Mo^{93}
42 51
$>2^{y}$

Levels $Nb^{93}(p,n)$ $E_p = 4.25$ scin
30† g.s. (Q = −1.27)
40† 1.46
Four weaker, doubtful peaks

R.Patterson, Phys. Rev. 95, 303A (1954).

Mo^{95}
42 53
stable

I 5/2 Mo^{95} S
μ negative
$\mu(Mo^{97})/\mu(Mo^{95}) = 1.022$

E.C.Woodward, Jr., Phys. Rev. 93, 954A(1954).

Mo^{97}
42 55
stable

I 5/2 Mo^{97} S
μ negative
$\mu(Mo^{97})/\mu(Mo^{95}) = 1.022$

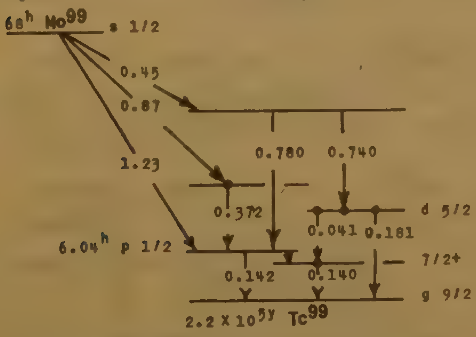
E.C.Woodward, Jr., Phys. Rev. 93, 954A (1954).

Mo^{99}
42 57
68^{h}

β^- 14% (0.45) βγ scin
~1% 0.87 Mo(slow n)
85% (1.23)

γ 0.041 α~5 0.372 scin
0.140 0.740
0.181 (0.780)

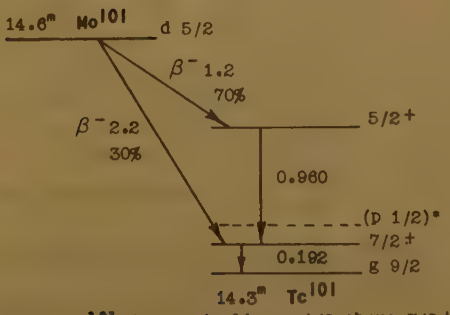
(0.87 β)(0.372 γ) No (1.23 β) γ
(0.740 γ)(0.041 γ, 0.140 γ, 0.181 γ)
(0.041 γ)(0.140 γ) No (0.372 γ) γ
No (0.780 γ)(0.041 γ, 0.140 γ, 0.181 γ)



J.Varma, C.E.Mandeville, Phys. Rev. 94, 91 780A(1954); J.Franklin Inst. 256, 573 (1953).

Mo^{101}
42 59
14.6^{m}

τ 14.6^{m} Mo^{100} (15-Mev d)
β^- 70% 1.2 a
30% 2.2
γ 0.20 scin
0.96



*Lack of Tc^{101} isomer implies p 1/2 above 7/2+
See also Tc^{101}

D.R.Wiles, Phys. Rev. 93, 181 (1954).

$Mo^{102?}$
42 60
12^{m}

τ 11.5^{m} 5 U(n,f) chem

J.Flegenheimer, W.Seelmann-Eggebert, Z.Naturf. 9a, 806 (1954).

Tc^{93}
43 50
43.5^{m}

0.39 γ assigned to $43.5^{m}Tc^{93}$ ms

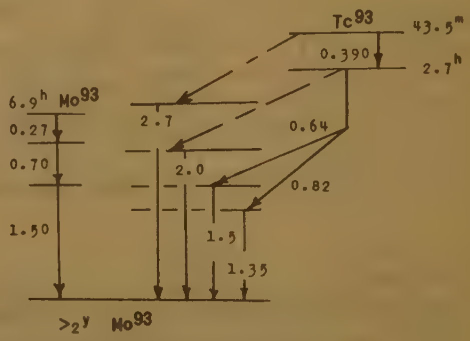
R.Bernas, J.Beydon, L.Papineau, Compt. rend. 238, 791 (1954).

Mo(6.7-Mev d) chem, ms
γ ~80%* 0.39 scin
~20%* 2.7
No (0.39 γ) γ No (2.7 γ) γ
*Transitions per 100 disintegrations

C.Levi, L.Papineau, Compt. rend. 238, 2313 (1954).

Tc^{93}
43 50
2.7^{h}

Mo(6.7-Mev d) chem, ms
β_1^+ 13† 0.64 sl
β_2^+ 26† 0.82
γ 200† 1.35 scin
100† 1.50
15† 2.0
(β^+)(1.35 γ, 1.50 γ)
No (2.0 γ)(> 0.3 γ) No 2.7 γ (< 15†)
$\beta_1^+/\epsilon_1 = \beta_2^+/\epsilon_2 = 0.15 \pm 0.05$



C.Levi, L.Papineau, Compt. rend. 238, 2313 (1954).

$\beta^+/\epsilon_K = 1.14 \pm 0.01$ GM
$\beta^+\gamma/\beta^+$ not f (E_β)
All ϵ_K and β^+ to one level $\beta^+\gamma/\beta^+ = x\gamma/x$

R.Sehr, Z. Phys. 137, 523 (1954).

Tc^{97}
43 54
91^{d}

τ_1 91^{d} Mo^{97} (19-Mev d) chem
γ 0.095 K/LM = 1.7 sl ce⁻
Tc K x rays crit a

G.Boyd, Phys. Rev. 95, 113 (1954).

Tc^{97}
43 54
$\sim 10^{5y}$

τ_2 10^4–10^{5y} Mo^{97} (19-Mev d) chem
Mo K x rays pc

G.Boyd, Phys. Rev. 95, 113 (1954).

Tc^{98}	$\sim 42^{m}$ activity not assignable to Tc^{98}			
43 55		Mo^{98}(7.4-Mev p) Mo^{95}(20-Mev α)		
?				

J.K.Lerohl, M.L.Pool, D.N.Kundu, R.A.House, Phys. Rev. 92, 934(1953).

Tc^{99}	I	9/2	S
43 56	μ	5.5	
2.2×10^{5y}	Q	+0.3	

K.G.Kessler, R.E.Trees, Phys. Rev. 92,303, (1953).

Tc^{101}	τ	14.3^{m}	Mo^{100}(15-Mev d)	chem
43 58	β^-	1.4		a
14.3^{m}	γ	0.30		scin

No isomer with $\tau > 3^{m}$ or $<2^{d}$ found from decay of 14.6^{m}Mo. All long-lived Tc found ascribed to $60^{d}\mathrm{Tc}^{95}$ and $90^{d}\mathrm{Tc}^{97}$

D.R.Wiles, Phys. Rev. 93, 181 (1954).

$\mathrm{Tc}^{102?}$	τ	5^{s} *1*	d 12^{m}Mo	chem
43 59				
5^{s}				

J.Flegenheimer, W.Seelmann-Eggebert, Z.Naturf. 9a, 806 (1954).

$\mathrm{Tc}^{104?}$	τ	3.8^{m} *2*	Ru(fast n)	chem
43 61				
3.8^{m}				

J.Flegenheimer, W.Seelmann-Eggebert, Z.Naturf. 9a, 806 (1954).

Ru Relative abundances $\mathrm{C}_{10}\mathrm{H}_{10}\mathrm{Ru}$ ms

%	A	%	A
5.50	96	17.01	101
1.91	98	31.52	102
12.70	99	18.67	104
12.69	100		

L.Friedman, A.P.Irsa, J. Am. Chem. Soc. 75, 5741 (1953).

Ru		Ru(α,α′γ)	$E'_{\alpha} = 3.0$	
stable	γ	0.091		scin
		0.128		
		0.360		

H.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

Ru Resonances Ru(n) E_n = 1 to 1000ev time of flight

E_0 (ev)	$\sigma_0\Gamma^2$
9.8	15
15.2	14
24.1	18.0
40.9	32.0

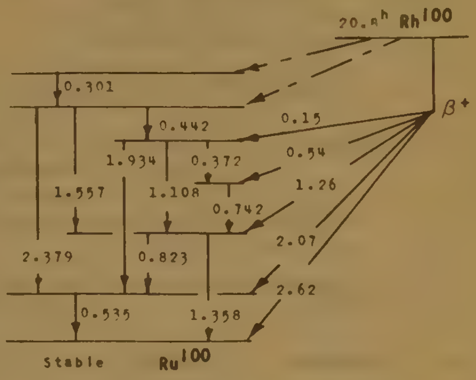
E.Melkonian, W.W.Havens, Jr., L.J.Rainwater, Phys. Rev. 92, 702 (1953).

$\mathrm{Rh}^{98?}$	τ	9^{m}	d 15^{m}Pd	chem
45 53	β^+	4.0		a
9^{m}				

A.H.W.Aten, Jr., T. de Vries-Hamerling, Physica 19, 1200 (1953).

Rh^{100}	τ		20.8^{h}	d 4.0^{d}Pd		
45 55	β^+	0.06†	0.15			sl
$20.8^{h.}$		3.6 †	0.54			
		13 †	1.26			
		39 †	2.07			
		45 †	2.62	F-K probably linear		
	γ	5.3 *	0.301	1.5*	1.108	
		0.9 *	0.372	2.8*	1.358	
		21.3 *	0.442	1.1*	1.557	
		100.0 *	0.535	0.4*	1.934	
		0.6 *	0.742	1.0*	2.379	
		9.7 *	0.823	*Rel. intensity ce^-		

$(ce^-\ 0.535\ \gamma)/\beta^+ = 0.062$ $\beta^+/\epsilon = 0.06$ (est.)



L.Marquez, Phys. Rev. 92, 1511 (1953).

Rh^{102}	τ	220^{d}	Ru(20-Mev d)	chem
45 57	β^+	1.27	spectrum complex	sl
210^{d}	β^-	1.12	spectrum complex	
	γ	0.127	0.76	scin
		0.198	1.07	
		0.474	1.11	
		0.62	1.58	
		0.70		

D.B.Kochendorfer, D.J.Farmer, Phys. Rev. 96, 855A (1954).

β^+	4†	0.40	Ag(420-Mev p)chem;	sl
	21†	0.76		
	59†	1.24		
β^-	100†	1.15	F-K plot linear	
γ	> 92*	0.086	K/LM > 2.5	sl ce^-
	32*	0.124	K/LM ~ 7.5	
	10*	0.195		
	1.5*	0.353		
	3*	0.475		

*Conversion electrons per 100 β^-

L.Marquez, Phys. Rev. 95, 67 (1954).

Rh^{103}	Levels	Rh^{103}(α,α′γ)	$E_{\alpha} = 6.0$	
45 58	γ	0.295		scin
stable		0.357		

H.P.Heydenburg, G.M.Temmer, Phys. Rev. 95, 861; 93, 351 (1954).

Rh^{104} γ (0.061) $\alpha_K = 1.9$ scin
45 59
4.3^m
E.Germagnoli, A.Malvicini, L.Zappa, Nuovo Cim. 10, 1388 (1953).

Rh^{104} γ 0.552 scin
45 59
44^s
No other γ with $E_\gamma > 0.2$

E.Germagnoli, A.Malvicini, L.Zappa, Nuovo Cim. 10, 1388 (1953).

Capture γ's Rh^{103} (n) s pr

0.5†	5.55	0.7†	6.20
0.5†	5.91	0.2†	6.36
0.6†	6.06	0.2†	6.79

Also graph $E_\gamma = 3$ to 7.2
$B_n(\mathrm{Rh}^{103}) = 6.8$ from Rh^{103}(d,p)
†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025 (1953).

Resonance Rh^{103} (n) cryst s
(1.26) ev $\sigma_0 = \sim 4850 \pm 200$*
$\Gamma = 0.156$
*Including Doppler correction found from $\sigma(E_n = 1.26$ ev) as f(T)

M.H.Landon, Phys. Rev. 94, 1215; 93, 931A (1954).

Resonance Rh^{103} (n)
(1.26)ev J = 1
$\Gamma_n/\Gamma = 0.004 \pm 0.003$

B.N.Brockhouse, Can. J. Phys. 31, 432 (1953).

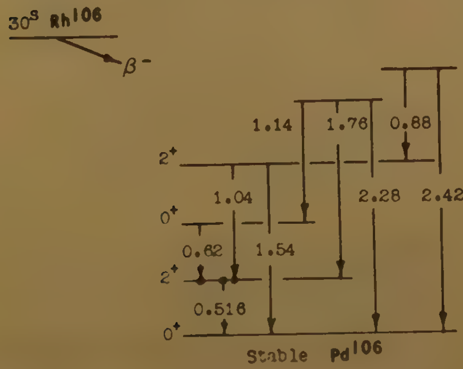
Rh^{105} Ru(pile n) chem
45 60 β^- 4% ~0.21 a$\beta\gamma$
36.5^h 96% (0.57)
γ 0.32 scin
$(\sim 0.21\,\beta)(0.32\,\gamma)$

C.Levi, L.Pepineau, Compt. rend. 238,1407 (1954).

Rh^{106} γ d 1.0^{y}Ru scin
45 61
30^s

20.5†	0.516		
10.4†	0.619	0.2†	1.54
0.3†	0.88	< 0.1†	1.76
1.7†	1.04	< 0.1†	2.28
0.4†	1.14	< 0.1†	2.42

†Photons per 100 disintegrations



B.Kahn, W.S.Lyon, Phys. Rev. 92,902 (1953).

Rh^{106} $(0.624\gamma)(0.513\gamma)(\theta)$ I = 0, 2, 0 scin
45 61 $(1.045\gamma)(0.513\gamma)(\theta)$ I = 2, 2, 0
30^s
$\gamma\gamma(\theta)$ coefficients differ by 3% from theory
No $(0.870\gamma)(1.045\gamma)$

E.D.Klema, F.K.McGowan, Phys. Rev. 92,1469, (1953).

Pd Resonances Pd(n) $E_n = 1$ to 50 ev
cryst s

w	13.3 ev
w	26 ev
st	34.1 ev (Pd^{109}?)

M.H.Landon, V.L.Sailor, Phys. Rev. 93,1030 (1954).

$\mathrm{Pd}^{98?}$ τ 15^m Ru(52-Mev α) chem
46 52 p 9^mRh chem
15^m

A.H.W.Aten, Jr., T. de Vries-Hamerling, Physica 19, 1200 (1953).

$\mathrm{Pd}^{100?}$ γ 0.0807 sl ce$^-$
46 54 In 4^d activity with 21^hRh from Ag(420-Mev p)
4.0^d

L.Marquez, Phys. Rev. 92, 1511 (1953).

Pd^{103} γ (0.040) K/LM = 0.16 pc
46 57 $\alpha_K = 70$
17^d
$E_\epsilon = 0.036$ from $\epsilon_{K}/\epsilon_K = 1.3$
$E_{dis} = 0.36 + 0.040$ (E_γ)

P.Avignon, J. phys. radium 14, 637 (1953).

Rh^{103}(26-Mev d) chem
γ scin

4†	0.26 ?
11†	0.305
60†	0.367
11†	0.503

$E_{dis} = 0.53 + 0.040$ (E_γ) scin
from continuous γ endpoint
†Photons per 10^4 disintegrations

L.H.Th.Rietjens, H.J.Van den Bold, P.M.Endt, Physica 20, 107 (1954).

Q values Rh^{103}(p,n) $E_p = 4.25$ ppl

-1.53	-2.98
-2.01	-3.26 ?
-2.64	

R.Patterson, Phys. Rev. 95, 303A (1954).

$\mathrm{Pd}^{105?}$ Pd$(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
46 59 γ 0.068? scin
stable

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Pd^{109} β^- 1.020 Pd(th n); sl
46 63
13.6^h J.Moreau, J. Phys. radium 15, 380 (1954).

Pd^{113} $_{46}$ $_{67}$ 1.5^m

τ 1.5^m D 5.3^hAg chem
U(190-Mev d) chem

H.G.Hicks, R.S.Gilbert, Phys. Rev. 94,371(1954)

Ag Capture γ's $Ag(n,\gamma)$ s pr

1.1†	6.06	0.1†	6.95
0.4†	6.27	0.3†	7.06
0.4†	6.55	0.4†	7.27
0.2†	6.67		

Also graph $E_\gamma = 3$ to 7.4
$B_n(Ag^{107?}) = 7.0$ from Ag(d,p)
†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025(1953).

Ag^{103} $_{47}$ $_{56}$ 1.1^h

τ 1.1^h Pd(12-Mev d) chem
γ 0.554 K/LM~5 $s\pi/2$ ce$^-$
0.764

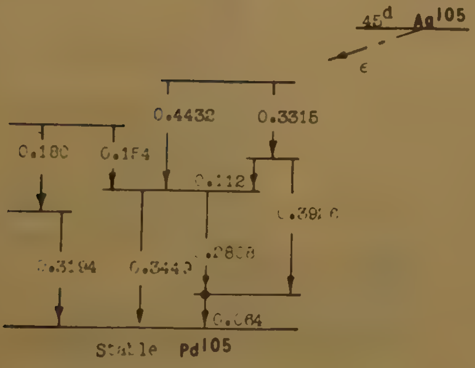
W.L.Bendel, F.J.Shore, H.N.Brown, R.A.Becker, Phys. Rev. 90, 888 (1953).

τ 1.1^h Ag(80-Mev p) chem
D 17^dPd chem
β^+ 1.3 a

B.C.Haldar, E.O.Wiig, Phys. Rev. 94,1713(1954).

Ag^{105} $_{47}$ $_{58}$ 45^d

γ 0.0640 d 54.7^mCd
0.2808 $K/L_1 \geq 5$ $s\pi$ ce$^-$ ppl
0.3194
0.3315
0.3449 $K/L_1 \geq 5$
0.3926
0.4432



F.A.Johnson, Can. J. Phys. 31, 1136 (1953).

Ag^{107} $_{47}$ $_{60}$ 44^s

γ 0.0930 d 6.7^hCd $s\pi$ ce$^-$
$L_1 : L_2 : L_3 = 0.2 : 1 : 1$

F.A.Johnson, Can. J. Phys. 31,1136(1953).

γ (0.094) $\alpha_K = 9.5$ E3 d 6.7^hCd
K/LM = 0.88 scin,sl ce$^-$

J.Brunner, O.Huber, R.Joly, D.Maeder, Helv. Phys. Acta 26, 588A(1953).

Ag^{107} $_{47}$ $_{60}$ stable

μ -0.11305 *1* $AgNO_3$ I
$\nu(Ag^{107})/\nu(Ag^{109}) = 0.86985$ *1*
$\nu(Ag^{109})/\nu(D) = 0.30316$ *3*

P.B.Sogo, C.D.Jeffries, Phys. Rev. 93, 174 (1954).

μ -0.113014 $AgNO_3$ I
$\nu(Ag^{107})/\nu(H) = 0.040468$ *1*

E.Brun, J.Oeser, H.H.Staub, C.G.Telschow, Phys. Rev. 93, 172 (1954).

Levels $Ag(p,p'\gamma)$ $E_p = 1.35$ to 2.0
γ ~0.090 τ~40^s scin ce$^-$
0.321

40^s activity yield as $f(E_p)$ indicates production by 0.5% branching from~0.4 level
Not produced by Ag(1.9-Mev α)

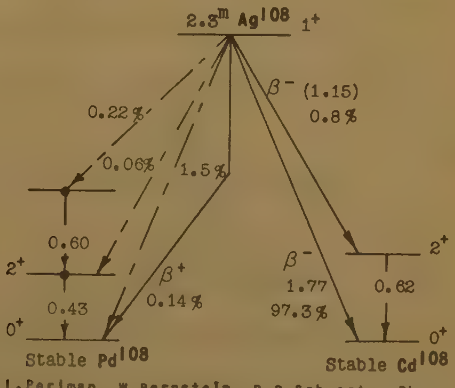
T.Huus, A.Lundén, Phil. Mag. 45, 966 (1954).

Levels $Ag^{107}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$
γ 0.318 scin
0.413

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 95, 861 (1954).

Ag^{108} $_{47}$ $_{61}$ 2.3^m

β^- (0.8%) (1.15) Ag(pile n) scin
97.3% 1.77
γ 100† 0.43 scin
79† 0.60
0.62
No 1.03γ No 0.19γ
(K x ray)(0.43γ,0.60γ) (0.60γ)(0.43γ)
No β^+ γ
$\epsilon_K/\beta^- = 0.016$ pc
15% ϵ to excited levels xγ/x
$\beta^+/\beta^- = 0.0014$



M.L.Perlman, W.Bernstein, R.B.Schwartz, Phys. Rev. 92, 1236 (1953).

Resonances $Ag^{107}(n)$ $E_n = 2$ to 100 ev
chopper

E_o (ev)	$\sigma_o\Gamma^2$
16.6	60
42.4	50
45.6	8
52.2	140

F.G.P.Seidl, D.J.Hughes, H.Palevsky, J.S.Levin, W.Y.Kato, N.G.Sjöstrand, Phys. Rev. 95, 476 (1954).

Ag^{109}
47 62
40^{s}

γ 0.0875 $\alpha_K = 9.5$ E3 d 470^{d}Cd
K/LM = 0.80 scin, slce$^-$
(K x ray)/(0.087 γ) = 34 scin

A.H.Wapstra, Arkiv Fysik 7, 265 (1954).

γ 0.0877 $\alpha_K \sim 6.4$ E3 d 13^{h}Pd
K/LM = 0.84 sl ce$^-$

J.Moreau, J. Phys. radium 15, 380 (1954).

γ 0.0879 d 470^{d}Cd $s\pi$ ce$^-$

F.A.Johnson, Can. J. Phys. 31,1136 (1953).

γ 0.087 $\alpha_K \sim 8.6$ E3 d 13^{h}Pd; pc

P. Avignon, J. phys. radium 14, 636 (1953).

γ (0.087) $\alpha_K = 12.4$ E3 d 470^{d}Cd
K/LM = 0.85 scin, slce$^-$

J.Brunner, O.Huber, R.Joly, D.Maeder, Helv. Phys. Acta 26, 588A (1953).

Ag^{109}
47 62
stable

μ −0.12996 *1* $AgNO_3$ I
$\nu(\mathrm{Ag}^{109})/\nu(\mathrm{D}) = 0.30316$ *3*

P.B.Sogo, C.D.Jeffries, Phys. Rev. 93, 174 (1954).

μ −0.129923 $AgNO_3$ I
$\nu(\mathrm{Ag}^{109})/\nu(\mathrm{H}) = 0.046523$ *1*

E.Brun, J.Oeser, H.H.Staub, C.G.Telschow, Phys. Rev. 93, 172 (1954).

Levels Ag(D,D'γ) $E_p = 1.35$ to 2.0
γ ~0.090 $\tau \sim 40^{s}$ scin ce$^-$
0.306
See also Ag^{107}

T.Huus, A.Lundén, Phil. Mag. 45, 966 (1954).

Levels $\mathrm{Ag}^{109}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$
γ 0.305 scin
0.400

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 95, 861 (1954).

Ag^{110}
47 63
270^{d}

β^- 107† 0.080 sl
32† 0.314
153† 0.530

T.Azuma, Phys. Rev. 94, 638 (1954).

Ag^{110}
47 63
24^{s}

τ_2 24^{s} Ag(pile n)
β^- 2.16 scin
2.84
γ 0.66 scin
W 0.72
W 0.81
W 0.88
0.94
$\beta/\gamma = 2^*$ scin

F.I.Boley, Phys. Rev. 94, 1078 (1954); *priv. [illegible]

Ag^{110}
47 63
24^{s}

Resonance Ag(n)
(5.2 ev) $\sigma_0 \sim 33{,}000$

J.E.Draper, C.P.Baker, Phys. Rev. 95, 644A (1954).

Resonance Ag(n,n)
(5.2 ev) J = 1 from σ_s and σ_t

R.E.Wood, Phys. Rev. 95, 644A (1954).

Resonances Ag^{109}(n) $E_n = 2$ to 100 ev chopper

E_0 (ev)	σ_0	Γ
5.22	27,000	0.168

	$\sigma_0\Gamma^2$
31.1	52
40.8	30
56.8	100
73	150
89	20

F.G.P.Seidl, D.J.Hughes, H.Palevsky, J.S.Levin, W.Y.Kato, N.G.Sjöstrand, Phys. Rev. 95, 476 (1954).

Ag^{111}
47 64
7.50^{d}

I 1/2 M
$|\mu|$ 0.144

A.Lemonick, F.M.Pipkin, Phys. Rev. 95,1356 (1954).

Cd

Cd($\alpha,\alpha'\gamma$) $E_\alpha = 3.0$
γ 0.300? scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Cd^{105}
48 57
54.7^{m}

τ 54.7^{m} Ag(20-Mev p) chem
β^+ 0.80 sl
1.691
γ 0.0255 L_2L_3/MN = 4 $L_2 \ll L_3$
0.0277 $s\pi$ ce$^-$
0.2630 0.3249 1.908
0.2925 0.3363 1.96
0.3080* 0.3407 2.00
0.3121 0.3470* 2.045
0.3171 0.4331* 2.277
0.3205* 0.6067 2.32
No $\beta^+\gamma$ for $E_\gamma > 0.5$
*Most intense lines

F.A.Johnson, Can. J. Phys. 31,1136 (1953); Proc. Roy. Soc. Canada, 46,135A (1952).

Cd^{107}
48 59
6.7^{h}

$\beta^+/0.85\gamma = 0.66 \pm 0.05$ scin

D.Maeder, R.Müller, V.Wintersteiger, Helv. Phys. Acta 27, 3 (1954).

Cd^{109}
48 61
470^{d}

(L x ray)/(K x ray) = 0.0505 pc
(K x ray)/(0.085γ) ~ 18 scin
$E_\epsilon = 0.067$ from $\epsilon_L/\epsilon_K = 0.32 \pm 0.04$
$E_{dis} = 0.067 + 0.087$ (E_γ)

G.Bertolini, A.Bisi, E.Lazzarini, L.Zappa, Nuovo Cim. 11, 539 (1954).

Cd^{109} $E_{\epsilon} = 0.07$ from $\epsilon_{L}/\epsilon_{K} = 0.28$ 3 4π scin
48 61 $E_{dis} = 0.07 + 0.087$ (E_{γ})
470^{d}

E. der Mateosian, Phys. Rev. 92,938(1953); 87, 193A(1952).

Cd^{111} γ (0.15) E3 > 99.7% $\gamma\gamma(\theta)$
48 63 $(0.15\gamma)(0.25\gamma)(\theta)$ I = 11/2, 5/2, 1/2
48.7^{m} Molten Cd metal

J.J.Kraushaar, R.V.Pound, Phys. Rev. 92,523, (1953).

Cd^{113} β^{-} 0.570 4π scin
48 65 No γ (< 1%)
5^{y}

E. der Mateosian, Phys. Rev. 95, 646A (1954); verbal report.

Cd^{114} Capture γ's Cd(n,γ) s pr
48 66
stable

2.2 †	5.94	0.12†	7.84
0.36†	6.82	0.23†	8.483
0.21†	7.67	0.14†	9.046
0.16†	7.73		

Also graph $E_{\gamma} = 2.8$ to 9.5
$B_{n}(Cd^{113}) \sim 9$ from mass measurements
†Photons per 100 n captures in Cd

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051(1953); Phys. Rev. 90, 355A(1953).

Capture γ's Cd(n,γ) scin
$(0.558\ \gamma)(8.48\ \gamma)$
No other $(0.558\ \gamma)\ \gamma$ for $E_{\gamma} > 5.0$

A.L.Recksiedler, B.Hamermesh, Phys. Rev. 96, 108 (1954); 95, 659A (1954).

Cd^{115} γ 100† 0.485 scin
48 67 73† 0.935
43^{d} 31† 1.30
$(0.485\ \gamma)(0.935\ \gamma)$
No 0.15 γ, 0.45 γ, 0.50 γ

J.Varma, Phys. Rev. 95, 613A (1954); verbal report.

Cd^{117} γ 0.267 1.27 $s\pi$ ce^{-}
48 69 0.281 1.55 scin
3.0^{h} 0.331* 2.00
0.43
0.84 Cd^{116} (pile n)

J.M.LeBlanc, J.M.Cork, S.B.Burson, Phys. Rev. 93, 916A (1954); * verbal report.

In In$(p,p'\gamma)$ $E_{p} = 3.0$
γ 0.500 scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

In^{111} γ (0.171) E2 1.3% M1 98.7%
49 62 $\gamma\gamma(\theta)$, $e^{-}\gamma(\theta)$, $\gamma e^{-}(\theta)$, $e^{-}e^{-}(\theta)$
2.8^{d}

F.Gimmi, E.Heer, P.Scherrer, Z. Phys. 138, 394 (1954); Helv. Phys. Acta 27, 180A (1954).

In^{114} β^{+} 0.004% ~1.2 a
49 65 γ 0.722 M1 96% E2 4% $\gamma\gamma(\theta)$
72^{s} $(0.72\ \gamma)(0.56\ \gamma)(\theta)$ I = 2, 2, 0
No low energy β^{-} (< 0.1%) $a\beta\gamma$

M.W.Johns, C.C.McMullen, R.J.Donnelly, S.V.Nablo, Can. J. Phys. 32, 35 (1954).

γ (0.722) M1 97% E2 3% $\gamma\gamma(\theta)$
$(0.72\gamma)(0.56\gamma)(\theta)$ I = 2, 2, 0

D.G.Alkhazov, I. Kh. Lemberg, A.P.Grinberg, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 487 (1953); Chem. Abstr. 48-2488a (1954).

γ 100† (0.556) scin
80† (0.722)
4† (1.271)

D.Maeder, R.Müller, V.Wintersteiger, Helv. Phys. Acta 27, 3 (1954).

$(0.556\ \gamma)(0.722\ \gamma)$ Σ scin
No $(1.30\ \gamma)(0.556\ \gamma)$

D.C.Lu, W.H.Kelly, Phys. Rev. 95, 121 (1954).

In^{115} In$(n,n')4.5^{h}$In $E_{n} = 0.4$ to 1.8
49 66 Levels* 0.60? scin
6×10^{14y} 0.96
1.37
1.75?
*Sharp increases in slope of σ curve

A.A.Ebel, C.Goodman, Phys. Rev. 93,197(1954).

In$(n,n')4.5^{h}$In $E_{n} = 0.4$ to 5.5
Threshold 0.4 scin
Levels* ~1
~1.35
*Flat sections of σ curve

H.C.Martin, B.C.Diven, R.F.Taschek, Phys. Rev. 93, 199 (1954); 92, 1096A (1953).

Levels In$(n,n'\gamma)$ $E_{n} = 2.5$
0.61*
0.92*
γ 0.25 scin
0.34
0.44
0.75 ?
0.87
*Inelastic neutrons detected

E.A.Elliot, D.Hicks, L.E.Beghian, H.Halban, Phys. Rev. 94, 144 (1954).

Magnetic octupole interaction observed M
Interaction constant = 0.000497 ± 33 Mc/sec

P.Kusch, T.G.Eck, Phys. Rev. 94, 1799 (1954).

In^{116} τ_{2} 13^{s} Sn(14-Mev n)
49 67 β^{-} ~2.8 a
13^{s}

Z.Wilhelmi, R.Brunsz, C.Dabrowski, Bull. Acad Polon. Sci. 1, 105 (1953).

In^{116} $_{49}$ $_{67}$ 13^s
β^- 3.29 In(pile n) scin
No γ

F.L.Boley, Phys. Rev. 94, 1078 (1954).

Capture γ's In(n,γ) s pr
1.1† 4.97 0.4† 5.55
1.0† 5.17 0.3† 5.73
0.8† 5.34 0.7† 5.86
Also graph $E_\gamma = 3$ to 8.2
$B_n(In^{115}) = 6.6$ from In(d,p)
†Photons per 100 n captures in In

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025(1953).

Resonance In(n)
(1.45)ev J = 4
$\Gamma_n/\Gamma = 0.043 \pm 0.006$

B.N.Brockhouse, Can. J. Phys. 31,432 (1953).

In^{117} $_{49}$ $_{68}$ 1.9^h
τ_1 2.3^h chem
γ 0.160 sπ ce$^-$
IT 0.312 scin
0.562*
0.725*
No $\beta(0.312\gamma)$

J.M.LeBlanc, J.M.Cork, S.B.Burson, Phys. Rev. 93, 916A(1954); * verbal report.

τ_1 1.90^h d 50^mCd chem
β^- 30% 1.616 sl ce$^-$
70% 1.772
γ 0.161 $\alpha_K = 0.13$ M1 sl ce$^-$,
0.311 $\alpha_K = 1.3$ M4 scin
$(\beta)(0.16\gamma)$ No $(0.31\gamma)(\beta,\gamma)$
p 1.1^hIn 28% Not d 3.0^hCd(< 10%)

C.L.McGinnis, Phys. Rev. 94, 780A (1954); verbal report.

In^{117} $_{49}$ $_{68}$ 1.1^h
τ_2 1.1^h d 3.0^hCd chem
β^- 0.740 sl
γ 86† 0.161 $\alpha_K = 0.13$ scin, sl ce$^-$
100† 0.565 $\alpha_K \sim 0.005$
$(\beta)(0.16\gamma, 0.57\gamma)$ $(0.16\gamma)(0.57\gamma)$
No 0.726 γ (< 1†)
d 1.9^hIn 28% Not p 14^d Sn (< 1%)

C.L.McGinnis, Phys. Rev. 94, 780A(1954); verbal report.

In^{118} $_{49}$ $_{69}$ 4.5^m
τ_1 4.5^m Sn(14-Mev n)

Z.Wilhelmi, R.Brunsz, C.Dabrowski, Bull. Acad Polon. Sci. 1, 105 (1953).

Sn
Sn($\alpha,\alpha'\gamma$) $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

Sn
Resonance Sn(n) $E_n = 3$ to 400 ev
63.4 ev chopper
Not assigned to isotope

R.S.Carter, J.A.Harvey, Phys. Rev. 95, 645A (1954); verbal report.

Capture γ's Sn(n,γ) s pr
0.4† 9.35
Also graph $E_\gamma = 3$ to 9.5. Spectrum complex.
†Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

Sn^{113} $_{50}$ $_{63}$ 118^d
Resonances Sn^{112}(n) $E_n = 3$ to 400 ev
96.5 ev chopper

R.S.Carter, J.A.Harvey, Phys. Rev. 95, 645A (1954); verbal report.

Sn^{117} $_{50}$ $_{67}$ 14^d
γ (0.161) E2 0.15%
$(ce_K^-\ 0.159\gamma)(0.161\gamma)(\theta)$

R.K.Golden, S.Frankel, Phys. Rev. 95, 613A (1954).

Sn^{117} $_{50}$ $_{67}$ stable
Resonance Sn^{116}(n) $E_n = 3$ to 400 ev
113 ev chopper

R.S.Carter, J.A.Harvey, Phys. Rev. 95, 645A (1954); verbal report.

Sn^{118} $_{50}$ $_{68}$ stable
Resonances Sn^{117}(n) $E_n = 3$ to 400 ev
39.4 ev chopper
124 ev

R.S.Carter, J.A.Harvey, Phys. Rev. 95, 645A (1954); verbal report.

Sn^{119} $_{50}$ $_{69}$ stable
Resonance Sn^{118}(n) $E_n = 3$ to 400 ev
46.4 ev chopper

R.S.Carter, J.A.Harvey, Phys. Rev. 95, 645A (1954); verbal report.

Sn^{120} $_{50}$ $_{70}$ stable
Resonance Sn^{119}(n) $E_n = 3$ to 400 ev
146 ev chopper

R.S.Carter, J.A.Harvey, Phys. Rev. 95, 645A (1954); verbal report.

Sn^{121} $_{50}$ $_{71}$ 27^h
Sn^{120}(n) $E_n = 3$ to 400 ev
No resonances observed chopper

R.S.Carter, J.A.Harvey, Phys. Rev, 95, 645A (1954).

Sb
Sb($\alpha,\alpha'\gamma$) $E_\alpha = 3.0$
γ 0.16 scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

Sb Capture γ's Sb(n,γ) s pr
0.5† 5.43 1.1† 6.33
1† 5.61 1.6† 6.50
1† 5.89 0.7† 6.80
1† 6.11
Also graph $E_\gamma = 3$ to 8
$B_n(Sb^{121?}) = 6.6$ from Sb(d,p)
†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025 (1953).

Sb^{121} q -0.5 enriched Sb^{121} S
51 70
stable K.Murakawa, Phys. Rev. 93, 1232 (1954).

Sb^{121} q -1.3 S
51 70 Based on $q(Sb^{123})/q(Sb^{121}) = 1.26^*$
stable

G.Sprague, D.H.Tomboulian, Phys. Rev. 92,105 (1953); 91,476A(1953); *H.G.Dehmelt, H.Kruger Z.Physik 130, 385 (1951).

Sb^{122} τ 2.75^d Sb^{121}(pile n)
51 71 β^- 8† ~0.45 $s\pi\sqrt{2}$
2.75^d 56† 1.40 F-K plot not linear
36† 2.00 $\Delta I = 2$, yes shape
No β^+
γ 0.095 $s\pi$ ce$^-$, scin
0.553 K/L~1 0.694
s 0.566 K/L = 7 1.10
0.616 1.2?
w 0.647 1.9?
x K x ray
(0.566 γ) (1.4 β, 0.694 γ)

J.M.Cork, M.K.Brice, G.D.Hickman, L.C.Schmid, Phys. Rev. 93, 1059 (1954).

Sb^{123} q -0.7 enriched Sb^{123} S
51 72
stable K.Murakawa, Phys. Rev. 93, 1232 (1954).

q -1.7 S

G.Sprague, D.H.Tomboulian, Phys. Rev. 92,105 (1953); 91, 476A(1953).

Sb^{124} β^- 0.360 0.925 s
51 73 0.582 1.585
60^d 0.745 2.295

γ 0.607 0.840 s pe$^-$
0.658 1.720
0.713 2.03

K.C.Mann, R.M.Pearce, Proc. Roy. Soc. Canada 47, 130A (1953).

β^- 9% 0.25 sl
53% 0.62
9% 0.94
7% 1.60
22% 2.31
(0.62 β) (> 0.80 γ) sl
($E_\beta = 0.30$) (1.68 γ) ($E_\beta = 1.00$) (0.60 γ, 0.72 γ)
($E_\beta = 1.60$) (0.603 γ)

J.Moreau, Compt. rend. 239, 820 (1954).

Sb^{124} γ 100† 0.603 scin
51 73 5.4† 0.99
60^d 6.2† 1.38
46† 1.71
10† 2.11

N.H.Lazar, Phys. Rev. 95, 292 (1954).

γ (0.60) E2
(2.27β) (0.60γ) polarization-direction

D.R.Hamilton, A.Lemonick, F.M.Pipkin, Phys. Rev. 92, 1191(1953); 90, 370A(1953).

γ 1.36 ? scin

D.C.Lu, W.H.Kelly, M.L.Wiedenbeck, Phys. Rev. 95, 1533 (1954).

(0.64γ) (0.72γ) (0.60γ) scin

L.M.Langer, J.W.Starner, Phys. Rev. 93, 253 (1954).

Sb^{125} β^- 29% 0.12 s
51 74 45% 0.300
$\sim 2.7^y$ 12% 0.444
14% 0.612 $\Delta I = 2$, yes shape
(0.12 β) (~0.62γ) (0.44 β) (0.175 γ)
(0.30 β) (~0.45γ) (0.175 γ) (~0.45 γ)
No (0.61 β) (γ)

J.Moreau, Arkiv Fysik 7, 391 (1954).

(K x ray) (0.425 γ, 0.601 γ) 4πscin
No (0.175 γ) (K x ray, γ)

D.C.Lu, W.H.Kelly, M.L.Wiedenbeck, Phys. Rev. 95, 121 (1954).

Te Te(α,$\alpha'\gamma$) $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Resonance Te(n)
2.33ev $\sigma_0 = 668$ $\Gamma = 0.114$

H.L.Foote, Jr., Phys. Rev. 94, 790A(1954).

Te^{121} γ (0.213) E2 5.8%
52 69 (ce$_K^-$ 0.082γ)(0.213γ)(θ)
154^d

N.Goldberg, S.Frankel, Phys. Rev. 93,1425 (1954).

Te^{123} γ Te^{122}(pile n)
52 71 0.159 $a_K = 0.19$ M1 scin
104^d From x/γ in spectrum coincident
with ce$_L^-$ of 0.088γ

F.K.McGowan, Phys. Rev. 93, 163 (1954).

γ (0.159) E2 1.2%
(ce$_K^-$ 0.088 γ) (0.159 γ) (θ)

N.Goldberg, S.Frankel, Phys. Rev. 93,1425 (1954).

$I^{119?}$
53 66
18^m

τ	18^m	Pd($\sim$100-Mev N)	chem

G.B.Rossi, W.B.Jones, J.M.Hollander, J.G.Hamilton, Phys. Rev. 93, 256 (1954).

I^{121}
53 68
1.4^h

τ	1.4^h	Pd($\sim$100-Mev N)	chem

G.B.Rossi, W.B.Jones, J.M.Hollander, J.G.Hamilton, Phys. Rev. 93, 256 (1954).

τ	1.5^h	d 40^mXe	chem
β^+			scin
γ	0.210	$\pi/2$ ce$^-$,	scin

H.B.Mathur, E.K.Hyde, Phys. Rev. 96, 126 (1954).

I^{122}
53 69
3.5^m

τ	3.5^m	d 19^hXe	chem
β^+	3.12 ¥		$\pi/2$
No γ observed			scin

H.B.Mathur, E.K.Hyde, Phys. Rev. 96,126 (1954).

I^{123}
53 70
13^h

τ	13^h	d 1.8^hXe	chem
γ	0.160	$\pi/2$ ce$^-$,	scin

H.B.Mathur, E.K.Hyde, Phys. Rev. 96,126 (1954).

I^{125}
53 72
60^d

$E_\epsilon = 0.11$ from $\epsilon_L/\epsilon_K = 0.23\ 3$ 4π scin
$E_{dis} = 0.11 + 0.035\ (E_\gamma)$

E. der Mateosian, Phys. Rev. 92,938 (1953); 87, 193A (1952).

I^{126}
53 73
13.3^d

β^-	72.5†	0.87	I^{127}(28-Mev d)chem; sl
	27.5†	1.26	
β^+	2.7†	1.21	
γ			sl ce$^-$ pe$^-$; scin
		0.386	$\alpha_K = 0.016$ K/LM ≥ 8
		0.670	

No 0.54 β^+ (<1.3†)
(0.87β) (0.39γ) (K X ray) (0.67γ)
ϵ_K/(0.67γ) = 1.35 (0.67γ)/(0.39γ) = 1.0

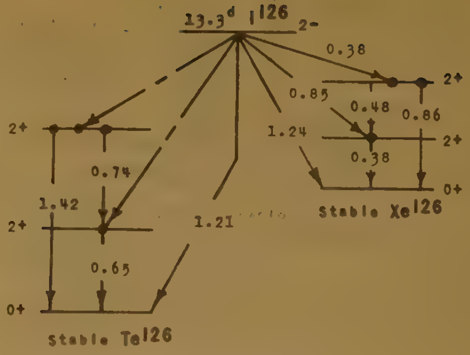
M.Marty, H.Langevin, P.Hubert, J. phys. radium 14, 663 (1953); Compt. rend. 236,1153 (1953).

τ		13.3^d	I^{127}(26-Mev n)		chem
β^+		1.19			scin β(0.511 γ)
γ	320†	0.382	37†	0.74	scin
	31†	0.48	5.9†	0.86	
	310†	0.65	3.8†	1.42	

(x ray) (0.74 γ, 1.42 γ, ce$^-$ 0.38 γ, 0.85 β)
β(0.38 γ, $\sim$0.5 γ) (0.38 γ) (0.48 γ, 0.85 β)
(0.65 γ) (x ray, 0.74 γ) (0.38 β) (0.86 γ)
No (x ray) (0.38 γ, 0.86 γ, 0.04 to 0.160 ce$^-$)
No γ (0.86 γ, 1.42 γ) No β(0.65 γ, 0.74 γ)
No (> 0.96 β) ($\gtrless$ 0.511 γ)

(CONTINUED)

I^{126}
53 73
13.3^d



M.L.Perlman, J.Welker, Phys. Rev. 95, 133, 613A (1954).

I^{127}
53 74
stable

Q	-0.819	M

V.Jaccarino, J.G.King, H.H.Stroke, quoted by R.Livingston, et al Phys. Rev. 92,1271 (1953).

Q	-0.75	S

K.Murakawa, S.Suwa, Z. Phys. 137,575 (1954).

Magnetic octupole moment = +0.3 μ_o barns M
Interaction constant = 0.00245 ± 37 Mc/sec

V.Jaccarino, J.G.King, R.A.Satten, H.H.Stroke, Phys. Rev. 94, 1798 (1953).

Levels	I^{127}(n,n'γ)	$E_n = 2.7$	
γ	0.046	0.41	scin
	0.20	0.63	

J.B.Guernsey, C.Goodman, Phys. Rev. 95, 636A (1954); R.M.Kiehn, C.Goodman, Phys. Rev. 95, 636A (1954).

	I^{127}(α,α'γ)	$E_\alpha = 3.0$	
γ	0.057		scin
	0.205		

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

I^{128}
53 75
25.0^m

γ	0.436	scin

E.Germagnoli, A.Malvicini, L.Zappa, Nuovo Cim. 10, 1388 (1953).

Capture γ	I^{127}(n,γ)	scin
	0.255	

γ energy range observed 0.1 to 2.0

M.Reier, M.M.Shamos, Phys. Rev. 95, 636A (1954).

I^{128}
53 75
25.0^m

Resonances	$I^{127}(n)$		$E_n = 15$ to 100 ev	
	E_o (ev)	$\sigma_o\Gamma^2$	chopper	
	20.5	10		
	31.4	100		
	37.7	180		
	46	80		
	66	~5		
	78	~60		
	91	~50		

F.G.P.Seidl, D.J.Hughes H.Palevsky, J.S. Levin, W.Y.Kato, N.G.Sjöstrand, Phys. Rev. 95, 476 (1954).

I^{129}
53 76
1.7x10^{7y}

β^-	0.150	$\Delta I = 2$, no	sl
γ	0.038	$\alpha_K = 22$	pc
		K/L~10	sl ce$^-$

No 0.188 β(< 1%) 4π scin

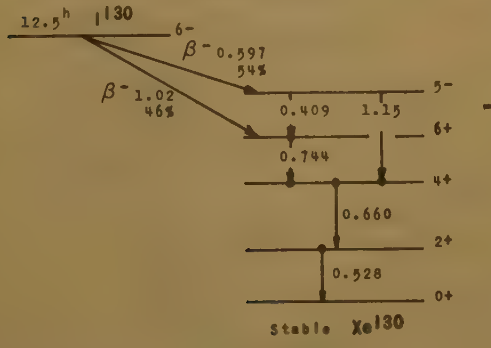
E. der Mateosian, C.S.Wu, Phys. Rev. 95, 458 (1954); 91, 497A (1953).

I^{130}
53 77
12.5^h

Te^{130}(11-Mev d) chem

β^-	54%	0.597			sl
	46%	1.02			
			$\alpha_K(x10^3)$	K/LM	
γ	30†	0.409	16	11	
	100†	0.528	5.5	8	E2
	90†	0.660	3.2	16	E2
	80†	0.744	2.7	4	E2
	40†	1.15	0.25		E1

(0.744 γ)(0.660 γ, 0.528 γ, 0.409 γ)
(1.15 γ)(0.660 γ, 0.528 γ)
No β^- with E_β > 1.02



R.S.Caird, A.C.G.Mitchell, Phys. Rev. 94,412, 780A (1954).

I^{131}
53 78
8.05^d

I	7/2	CH$_3$I^{131}	Mic
q	-0.412*		

q (I^{131})/q(I^{127}) = 0.5031
*Based on q(I^{127}) = -0.819 (See I^{127})

R.Livingston, B.M.Benjamin, J.T.Cox, W.Gordy, Phys. Rev. 92, 1271 (1953).

γ	(0.080)	Te(pile n)	chem
		K/L = 6.8	L/MN = 4.8
		K/LM = 5.7	

G.J.Nijgh, L.Th.M.Ornstein, N.Grobben, Physica 20, 243 (1954).

I^{131}?
53 78
8.05^d

γ	~0.514	scin, Cpt

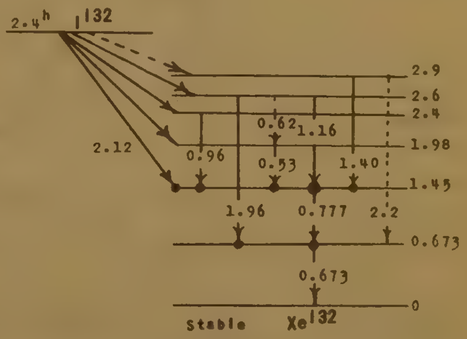
τ = 8^d. Intensity 1-2% of 0.364 γ

M.Sakai, B.Murray, J.D.Kurbatov, Phys. Rev. 96, 826A (1954).

I^{132}
53 79
2.4^h

β^-	15%	(0.73)		U(n,f)	chem; sl
	20%	0.9	24%	1.53	
	23%	1.16	18%	2.12	
γ	25†	0.528			8π ce$^-$
	6†	0.624			sl pe$^-$
	94†	0.673	$\alpha_K = 0.0027$		8π ce$^-$
	80†	0.777			
	20†	0.96			scin
	8†	1.16			
	11†	1.40			
	~5†	1.96			
	2†	2.2			†From scin

(2.12 β)(0.673 γ, 0.777 γ)
(0.528 γ)(0.673 γ, 0.777 γ)
(0.96 γ)(0.673 γ, 0.777 γ)
(1.16 γ)(0.673 γ, 0.777 γ)
(1.40 γ)(0.673 γ, 0.777 γ)
(0.673 γ)(0.624 γ, 0.777 γ, 1.96 γ)
No K x ray observed scin
No γ with E_γ < 0.50 sl pe$^-$



H.L.Finston, W.Bernstein, Phys. Rev. 95, 71 (1954).

I^{134}
53 81
53^m

β^-	1.5	d 44^{m}Te	chem; $\beta\gamma$ scin
	2.5		scin
γ	0.120 ?		scin
	0.200 ?		
	0.86		
	1.10		
	1.78		

(2.5 β)(0.86 γ) (1.5 β)(1.10 γ, 1.78 γ?)

M.McKeown, S.Katcoff, Phys. Rev. 94,965(1954).

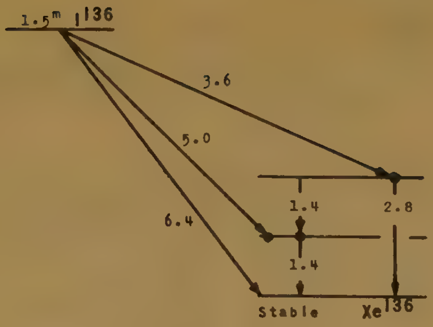
I^{136}
53 83
1.5^m

β^-		3.7	U(n,f)chem;	$\beta\gamma$ scin
		5.0		
		6.3		scin
γ	s	1.38		scin
		2.9		

(5.0 β)(1.4 γ) (3.7 β)(2.9 γ)
(1.4 γ)(1.4 γ) No (6.3 β)(γ)

(CONTINUED)

I^{136}
53 83
1.5^m



M.McKeown, S.Katcoff, Phys. Rev. 94, 965 (1954).

Xe^{121}
54 67
40^m

τ ~40^m I^{127}(100-Mev p) chem
β^+ scin
γ 0.096 sm/2 ce$^-$

H.B.Mathur, E.K.Hyde, Phys. Rev. 96,126(1954).

Xe^{122}
54 68
19^h

τ 19^h I^{127}(100-Mev p) chem
K x ray scin
γ 0.182 sm/2 ce$^-$, scin
0.235 scin

H.B.Mathur, E.K.Hyde, Phys. Rev. 96,126(1954).

Xe^{123}
54 69
1.8^h

τ 1.8^h I^{127}(100-Mev p) chem
K x rays d 6^{m}Cs chem
β^+ 1.7 a, scin
γ 0.148 sm/2 ce$^-$, scin

H.B.Mathur, E.K.Hyde, Phys. Rev. 96,126(1954).

Xe^{125}
54 71
55^s

τ_1 55^S d 45^{m}Cs(~0.1%) recoil
γ IT? 0.075* scin
0.110 Cf Cs^{125}

*Possibly Pb fluorescent radiation

H.B.Mathur, E.K.Hyde, Phys. Rev. 95, 708(1954).

Xe^{125}
54 71
18^h

d 45^{m}Cs recoil
γ 0.056 scin
0.187
0.243
(0.460)

(0.056 γ) (0.187 γ)
No (0.243 γ) (0.056 γ, 0.187 γ) No 0.511 γ
0.056 γ preceeds 0.187 γ $\gamma\gamma/\gamma$

H.B.Mathur, E.K.Hyde, Phys. Rev. 95,708(1954).

Xe^{127}
54 73
75^s

τ_1 75^S d 6.3^{h}Cs(0.01%) recoil
γ 0.125 Cf Cs^{127} scin
IT 0.175

H.B.Mathur, E.K.Hyde, Phys. Rev. 95,708(1954).

Xe^{127}
54 73
36.4^d

τ_2 36.41^d I^{127}(20-Mev d)chem, ms
Determined Xe^{127} by isotopic dilution method over period of four months

S.Balestrini, Phys. Rev. 95, 1502 (1954).

Xe^{129}
54 75
8.0^d

Xe(pile n) ms
γ 0.0400 K/LM = 4.3 sl ce$^-$
0.196 K/LM = 2.1
(ce$^-_{LM}$ 0.040γ)/(ce^-_K 0.196γ) = 0.27

S.Thulin, Arkiv. Fysik 7, 269 (1954).

γ (0.196) α_K = 11 scin

I.Bergström, S.Thulin, A.H.Wapstra, B.Aström, Arkiv Fysik 7, 255 (1954).

Xe^{129}
54 75
stable

μ -0.77254 I
$\nu(\mathrm{Xe}^{129})/\nu(\mathrm{H})$ = 0.276633 5

E.Brun, J.Oeser, H.H.Staub, C.G.Telschow, Phys. Rev. 93, 904 (1954).

Xe^{131}
54 77
12.0^d

γ (0.164) α_K = 29 x/γ scin

I.Bergström, S.Thulin, A.H.Wapstra, B.Aström, Arkiv Fysik 7, 255 (1954).

Xe^{131}
54 77
stable

μ +0.68680 I
$\nu(\mathrm{Xe}^{131})/\nu(\mathrm{H})$ = 0.081976 1

E.Brun, J.Oeser, H.H.Staub, C.G.Telschow, Phys. Rev. 93, 904 (1954).

Xe^{133}
54 79
2.3^d

γ (0.232) α_K = 4.4 scin
From α_K(0.232 γ) = 3 α_K(0.081 γ) sl, scin

I.Bergström, S.Thulin, A.H.Wapstra, B.Aström, Arkiv. Fysik 7, 255 (1954).

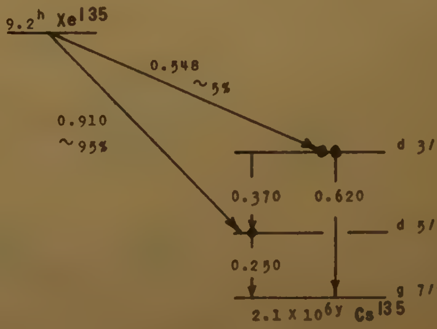
Xe^{133}
54 79
5.27^d

γ (0.081) α_K = 1.47 x/γ scin

I.Bergström, S.Thulin, A.H.Wapstra, B.Aström, Arkiv Fysik 7, 255 (1954).

Xe^{135}
54 81
9.2^h

β^- ~ 5% 0.548 $\beta\gamma$ sl
~95% (0.910)
γ 0.250 scin
0.37
0.60
(0.548 β) (0.60 γ)
(ce^-_K 0.25 γ) (0.37 γ) No (ce^-_K 0.25 γ) (0.60 γ)


9.2^h Xe^{135}
0.548
~5%
0.910
~95%
d 3/2
0.370
0.620
d 5/2
0.250
g 7/2
2.1 x 10^{6y} Cs^{135}

S.Thulin, Phys. Rev. 94, 734 (1954).

Cs^{123} τ 6^m I^{127}(130-Mev α) chem
55 68 D 1.8^hXe recoil
6^m β^+ 0.511 γ detected, scin

H.B.Mathur, E.K.Hyde, Phys. Rev. 95,708(1954).

Cs^{125} τ 45^m I^{127}(α)chem; ms
55 70
45^m M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

τ 45^m I^{127}(100-Mev α)chem, ms
β^+ 2.05 sm/2
γ 0.112 K/LM~3.6 sl ce^-
(0.112 γ)(K x ray, 0.511 γ)
D 55^sXe ~0.1%, D 18^hXe 100% recoil

H.B.Mathur, E.K.Hyde, Phys. Rev. 95,708(1954).

Cs^{127} τ 6.1^h I^{127}(α) chem; ms
55 72
6.3^h M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

τ 6.3^h I^{127}(60-Mev α)chem, ms
β^+ 0.68 sl
1.06
γ 10† 0.125 K/LM = 7.9 sm/2 ce^-
w 0.169 ?
w 0.196 ?
w 0.285 ?
w 0.363 ?
80† 0.406 K/LM = 6.3
vw 0.440 $\gamma\gamma$ scin
(x ray)(0.125 γ, 0.406 γ, 0.440 γ)
(0.511 γ)(0.125 γ, 0.406 γ)
(0.125 γ)(0.440 γ)
No (0.125 γ)(0.406 γ)
$\epsilon_K/\beta^+ > 15$ scin
D 75^sXe ~0.01% recoil

H.B.Mathur, E.K.Hyde, Phys. Rev. 95,708(1954).

Cs^{130} τ 30^m I^{127}(α) chem; ms
55 75
30^m M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

Cs^{131} E_{dis} 0.353 d 13^d Ba chem
55 76 From continuous γ endpoint scin
10^d No 0.080 γ ($<10^{-5}$%) crit a
Not p 12.0^dXe ($<10^{-8}$%) Xe separation

B.Saraf, Phys. Rev. 94, 642, 793A (1954); J. Franklin Inst. 257, 248 (1954).

Cs^{133} Q -0.003 2 double res
55 78
stable K.H.Althoff, H.Krüger, Naturwiss. 41, 368 (1954).

Cs^{133} $Cs^{133}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
55 78 γ 0.085 scin
stable

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Cs^{134} I 8 M
55 79 $|\mu|$ 1.10
3.15^h

L.S.Goodman, S.Wexler, Phys. Rev. 95,570(1954).

V.W.Cohen, D.A.Gilbert, Phys. Rev. 95, 569 (1954).

γ 0.0105 $\alpha \sim 200$ M1 DC
$\tau \lesssim 10^{-7s}$
0.1271 $\alpha_K = 2.6$ E3 sm ce^-
0.8% 0.1374 K/L~2 M4
(0.0105 γ)(0.1271 γ)
(0.0105 γ)/(K x ray)~0.02 DC

A.W.Sunyar, J.W.Mihelich, M.Goldhaber, Phys. Rev. 95, 570 (1954).

Cs^{134} γ (0.57) M1 $\gamma\gamma(\theta)$
55 79 $\gamma\gamma(\theta)$ I = 5, 4, 2, 0
2.3^y

D.G.Alkhazov, I. Kh. Lemberg, A.P.Grinberg, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 487 (1953); Chem. Abstr. 48-2488a (1954).

Resonance Cs^{133}(n) cryst s
5.90 ev $\sigma_0 \sim 9500$ $\Gamma = 0.12$

H.M.Landon, V.L.Sailor, Phys. Rev. 93,1030 (1954).

Resonances Cs^{133}(n) E_n = 40 to 400 ev
47.8 ev 146 chopper
83.1 206
95 237
128 299

R.S.Carter, J.A.Harvey, Phys. Rev. 95, 645A (1954); verbal report.

Cs^{136} τ 12.9^d U(190-Mev d,f), ms
55 81 β^- 92.6% 0.341 sl
12.9^d 7.4% 0.657

γ	K/L	
0.0672	3.5	pc
0.153	5.9	sl ce^-
0.162	1.0	sl ce^-
0.265		scin
0.335	5.2	sl ce^-
0.822	3.0	sl ce^-
1.041		sl ce^-
1.245		sl ce^-
1.41		scin
2.35		
2.49		

(0.153 γ)(0.162 γ, 1.245 γ)

J.L.Olsen, G.D.O'Kelley, Phys. Rev. 95, 1539 (1954).

Cs^{137} β^- 0.523 $\Delta I = 2$, yes shape sl
55 82
33^y

J.L.Olsen, G.D.O'Kelley, Phys. Rev. 93,1125 (1954).

β^- 0.526 $\Delta I = 2$, yes shape sl

P.Macq, Ann. Soc. Sci. Bruxelles 67,309(1954).

β^- 0.518 $\Delta I = 2$, yes shape sl
γ 0.663 $\alpha_K = 0.096$
$K:L:M = 4.6:1:0.07$

T.Azuma, J. Phys. Soc., Japan 9, 1 (1954).

Ba
Ba(α,$\alpha'\gamma$) $E_\alpha = 3.0$
γ 0.060 scin
0.118

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

Capture γ's Ba(n,γ) s pr

5†	3.66	0.4†	6.44
13†	4.10	0.4†	6.68
3†	4.70	0.1†	7.18
1†	4.98	0.1†	7.79
3.7†	5.74	0.1†	9.23
1†	6.06		

Also graph $E_\gamma = 2.5$ to 9.5
Ba(γ,n) thresholds known at 6.8 and 8.6
†Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051(1953).

Ba^{133} γ 1† 0.057 Ba(pile n) scin
56 77
10^y
22† 0.082 $\alpha = 3.5$ M1
31† 0.300
69† 0.357
(0.082γ)(0.057γ, 0.300γ, 0.357γ)
(0.057γ)(0.300γ) No (0.357γ)(0.300γ, 0.057γ)

R.W.Hayward, D.D.Hoppes, H.Ernst, Phys. Rev. 93, 916A (1954).

Cs^{133}(7-Mev d) chem
γ 0.073 crit a, scin
0.082
0.294
0.363
No β^+ (< 0.1%)

M.Langevin, Compt. rend. 238, 1310 (1954).

Ba^{137} d 33^{y}Cs
56 81 γ 0.662 $\alpha_K = 0.092$ M4 sm/2 ce$^-$
2.60^m
$K:L:MN = 58:10:2.2$

A.H.Wapstra, Arkiv. Fysik 7, 275 (1954).

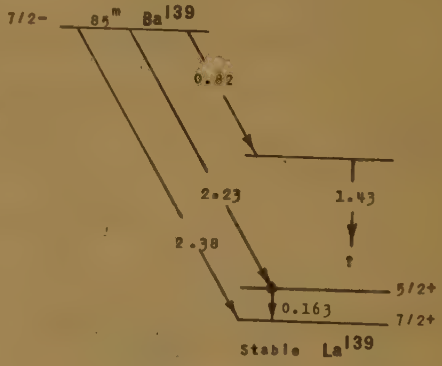
γ 0.6626 9 ce^-_K EA

S.K.Bhattacherjee, B.Waldman, W.C.Miller, Phys. Rev. 95, 404 (1954).

Ba^{137} d 33^{y}Cs
56 81 γ 0.661 $\alpha_K = 0.11$ M4 s
2.60^m
$K:L:M = 6:1:0.24$

V.M.Dolishnyuk, G.M.Drabkin, V.I.Orlov, L.I.Rusinov, Doklady Akad. Nauk SSSR 92,1141 (1953); NSF-tr-22 9.

Ba^{139} β^- 19% 0.82 Ba(12-Mev d)chem; sl
56 83
85^m
66% 2.23
15% 2.38
γ 0.163 $\alpha_K = 0.22$ M1 sl ce$^-$
K/LM = 7.0
1.43 sl pe$^-$
(2.23 β) (0.163 γ)



A.C.G.Mitchell, E.Hebb, Phys. Rev. 95, 727 (1954).

γ 100† 0.165 $\alpha_K = 0.20$ scin
No 0.056 γ (< 0.2†)
No 0.275 γ (< 1†) Ba(28-Mev d) chem

R.N.Nussbaum, R. van Lieshout, Physica 20, 440 (1954).

La No α activity $\tau > 5\times10^{15\,y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf. 9a, 701 (1954).

La^{139} q +0.9 s
57 82
stable

K.Murakawa, J. Phys. Soc. Japan 9, 391(1954); Phys. Rev. 92, 325 (1953).

La(α,$\alpha'\gamma$) $E_\alpha = 3.0$
γ 0.170 scin
No 0.066 γ

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 906 (1954); priv. comm.

La^{140} τ 40.22^h 2 d 13^{d}Ba chem
57 83
40.2^h
Counted for 14 half-lives

H.W.Kirby, M.L.Salutsky, Phys. Rev. 93, 1051 (1954).

La^{140} 57 83 40.2^h	β^-	12%	0.83			d 13^dBa chem; $s\pi$
		26%	1.10			
		45%	1.34			
		10%	1.67			
		7%	2.15			
	γ		0.110	10†	0.328	$s\pi$ ce$^-$,
			0.130	10†	0.485	pe$^-$
			0.240	10†	0.815	
			0.270	100†	1.60	

C.L.Peacock, J.F.Quinn, A.W.Oser, Jr., Phys. Rev. 94, 372, 804A (1954).

Resonance La(pile n)40.2^hLa
76 ev B absorption

H.W.Newson, R.H.Rohrer, Phys. Rev. 94, 654 (1954); 87, 177A (1952).

Ce No α activity $\tau > 4\times10^{16y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf. 9a,701(1954).

Ce?		Ce$(\alpha,\alpha'\gamma)$	$E_\alpha = 3.0$	
	γ	0.077		scin
		0.129		

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

Ce^{139} 58 81 140^d	γ	0.166	K/LM = 6.6 scin, $s\pi$ ce$^-$ $\tau < 10^{-8s}$

$e_A/ce^-_K = 0.34$
No other γ No β^+

C.H.Pruett, R.G.Wilkinson, Phys. Rev. 95, 625A (1954).

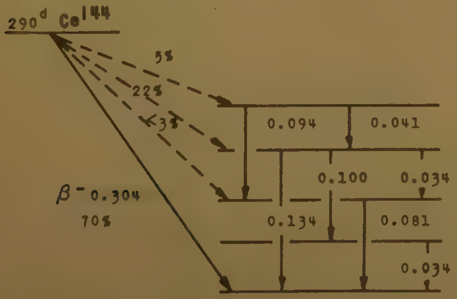
Ce^{141} 58 83 32.8^d	γ	(0.145)	M1	$\gamma(\theta,T)$

$\gamma(\theta,T)$ studied for aligned Ce nuclei

E.Ambler, R.P.Hudson, G.M.Temmer, Phys. Rev. 95, 625A (1954).

Ce^{144} 58 86 290^d	β^-	70%	0.304		U(n,f)chem;	sl
				K/L	L/M	sl ce$^-$
	γ	15†	0.034		3	
		12†	0.041		11	
		3†	0.053			
		59†	0.081	5	9	M2
		7†	0.094			
		5†	0.100			
		115†	0.134	8	≥4	M1

$(0.134\gamma)/(0.081\gamma) \sim 15$ scin
†Relative intensity ce$^-$



W.S.Emmerich, W.J.Auth, J.D.Kurbatov, Phys. Rev. 94, 110; 794A (1954).

$\mathrm{Ce}^{145?}$ 58 87 3^m	τ	3.0^m	U(pile n)	chem; p 6^hPr
	β^-	~2.0		a
	γ's			

S.S.Markowitz, W.Bernstein, S.Katcoff, Phys. Rev. 93, 178 (1954).

Ce^{146} 58 88 14^m	β^-		0.7	U(n,f) chem;	scin
	γ	w	0.05		scin
		20†	0.110		
		42†	0.142		
		50†	0.22		
		w	0.25		
		12†	0.27		
		100†	0.32		

$(0.05\gamma)(0.27\gamma)$ $(0.110\gamma)(0.22\gamma, 0.25\gamma)$
$(0.142\gamma)(0.22\gamma)$ No$(0.32\gamma)(\gamma)$
β(all γ's)

W.Bernstein, S.S.Markowitz, S.Katcoff, Phys. Rev. 93, 1073 (1954).

Pr^{141} 59 82 stable No α activity $\tau > 2\times10^{16y}$ for $1.5 < E_\alpha < 2.5$

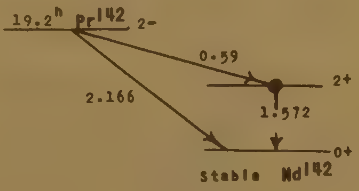
W.Porschen, W.Riezler, Z.Naturf. 9a,701(1954).

Pr^{141} 59 82 stable		$\mathrm{Pr}^{141}(\alpha,\alpha'\gamma)$	$E_\alpha = 3.0$	
	γ	0.15		scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Pr^{142} 59 83 19.2^h	β^-	~7%	0.59	Pr^{141}(pile n); sl $\beta\gamma$
		~93%	2.166	$\Delta I = 2$, yes shape sl
	γ		1.572	scin, sl pe$^-$

$(0.59\beta)\gamma$



A.V.Pohm, W.E.Lewis, J.H.Talboy, Jr., E.N.Jensen, Phys. Rev. 95, 1523 (1954).

Capture γ's	$\mathrm{Pr}^{141}(n,\gamma)$				s pr
	3†	4.69	3†	5.67	
	2†	4.79	2†	5.83	
	3†	5.16			

Also graph $E_\gamma = 2.5$ to 6.5
$B_n(\mathrm{Pr}^{141}) = 5.65$ from $\mathrm{Pr}^{141}(d,p)$*
†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025 (1953); *N.S.Wall, priv. comm.

Resonance Pr^{141}(pile n)19.2^hPr
~380 ev B absorption

H.W.Newson, R.H.Rohrer, Phys. Rev. 94, 654 (1954).

Pr^{144}
59 85
17.5^{m}

β^- 3% 0.8 d 290^{d}Ce sl
2% 2.3
95% 2.98

γ 0.060 ? K/L = 1 $s\pi$ ce$^-$(Nd)
(0.695) scin
(1.480)
(2.185)

No 0.060 photon scin

W.S.Emmerich, W.J.Auth, J.D.Kurbatov, Phys. Rev. 94, 110, 794A (1954).

γ 1.8† (0.695) d 290^{d}Ce; scin
0.32† (1.480)
0.83† (2.185)

†Photons per 100 disintegrations assuming photons of 0.134 γ in 20.7% of Ce^{144} (parent)

C.S.Cook, W.E.Kreger, Phys. Rev. 96, 855A (1954).

γ (1.480) E1 99.9% $\gamma\gamma(\theta)$

R.M.Steffen, Phys. Rev. 95, 614A (1954).

Pr^{145}?
59 86
6.0^{h}

τ 6.0^{h} d 3^{m}fission Ce chem
β^- ~1.7 a

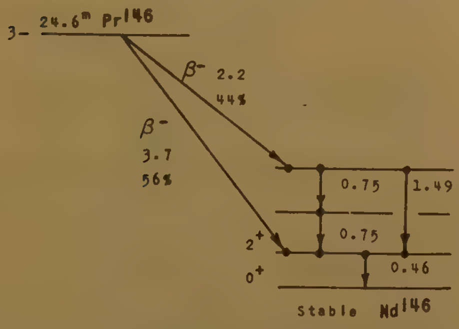
S.S.Markowitz, W.Bernstein, S.Katcoff, Phys. Rev. 93, 178 (1954).

Pr^{146}
59 87
24.6^{m}

β^- 44† 2.3 d 14^{m}Ce chem; scin
56† 3.7

γ 100† 0.46 scin
w 0.59?
22† 0.75 (double)
33† 1.49

$(0.46\gamma)(3.7\beta^-, 0.75\gamma, 1.49\gamma)$
$(2.3\beta^-)(0.75\gamma, 1.49\gamma)$ $(0.75\gamma)(0.75\gamma)$
No $(0.59\gamma)(\gamma)$ No $(0.75\gamma)(1.49\gamma)$



W.Bernstein, S.S.Markowitz, S.Katcoff, Phys. Rev. 93, 1073 (1954).

Nd

Nd(p,p'γ) E$_p$ = 2.25 scin
γ 0.136
$p(0.136\gamma)(\theta)$ b = 0.2

B.E.Simmons, D.M. Van Patter, K.F.Famularo, R.V.Stuart, Phys. Rev. 96, 826A (1954).

Nd

Nd(α,$\alpha'\gamma$) E$_\alpha$ = 3.4
γ 0.070 scin
0.128
0.290

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399; 93, 906 (1954).

Nd^{143}
60 83
stable

$|\mu|$ 1.0 para
Q ~1

$\mu(\text{Nd}^{143})/\mu(\text{Nd}^{145}) = 1.6083 \pm 0.0012$

B.Bleaney, H.E.D.Scovil, R.S.Trenam, Proc. Roy. Soc. 223A, 15 (1954).

Nd^{144}
60 84
~1.5x10^{15y}

τ ~1.5 X 10^{15y} ppl
α 1.9

Natural Nd purified to constant α spectrum
Shell model suggests Nd^{144} assignment

E.C.Waldron, V.A.Schultz, T.P.Kohman, Phys. Rev. 93, 254 (1954).

τ ~5X10^{15y} ppl
α 1.8

Sm removed by ion chem
Shell model suggests Nd^{144} assignment

W.Porschen, W.Riezler, Z.Naturf. 9a,701(1954).

Nd^{145}
60 85
stable

$|\mu|$ 0.62 para
Q ~1

B.Bleaney, H.E.D.Scovil, R.S.Trenam, Proc. Roy. Soc. 223A, 15 (1954).

Sm

Sm(α,$\alpha'\gamma$) E$_\alpha$ = 3.4
γ 0.082 scin
0.122
0.186

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399; 93, 906 (1954).

Sm^{146}
62 84
5X10^{7y}

τ 5 x 10^{7y} Nd(40-Mev α) chem
α 2.55 ppl

τ from yield relative to 410^{d}Sm^{145}, 47^{h}Sm^{153}

D.C.Dunlavey, G.T.Seaborg, Phys. Rev. 92, 206 (1953).

Sm^{147}
62 85
1.25X10^{11y}

I 7/2 S
μ -0.76
$|Q|$ < 1

$\mu(\text{Sm}^{147})/\mu(\text{Sm}^{149}) = 1.20$

K.Murakawa, Phys. Rev. 93, 1232 (1954).

τ 1.25x10^{11y} 78% Sm^{147} pc

G.Beard, M.L.Wiedenbeck, Phys. Rev. 95, 1245 (1954).

Sm^{149} 62 87 stable	I	7/2	S
	μ	-0.64	
	$\lvert q \rvert$	< 1	

K.Murakawa, Phys. Rev. 93, 1232 (1954).

Sm^{150} 62 88 stable	Capture γ's	Sm(n,γ)			s pr
	0.07†	5.99	0.3†	7.24	
	0.06†	6.54	0.03†	7.89*	
	0.04†	6.79			

Also graph $E_\gamma = 2.5$ to 8

*Probably not g.s. γ which would be M3 or E4

†Photons per 100 n captures in Sm

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

Resonance (ev) Sm(n) $E_n = 0.03$ to 0.16 ev

0.096 $\Gamma_n/\Gamma = 0.0082$ J = 4

B.N.Brockhouse, Can. J. Phys. 31, 432 (1953).

Resonance (ev) Sm(n)

0.0962 $\sigma_0 = 111{,}000$ $\Gamma = 0.0655$

Data indicate existence of a lower resonance

A.W.McReynolds, E.Andersen, Phys. Rev. 93, 195 (1954).

Resonance (ev) Sm(n) $E_n = 0.07$

(0.096) J = 4*

*From polarization of neutron beam transmitted by aligned Sm

L.D.Roberts, S.Bernstein, J.W.T.Dabbs, C.P.Stanford, Phys. Rev. 95, 105 (1954).

Sm^{153} 62 91 47^h	β^-**	32%*	0.64			sl
		49%	0.70			
		19%	0.81			
	γ		0.0690	$\alpha = 6$ K/L > 4.6	slce$^-$	scin
			0.1026	K/L > 6.1 $\tau = 4.0 \times 10^{-9}$s		βce$^-$
		0.033†*	0.1717	K/L = 4.5* $\tau = 1.4 \times 10^{-10}$s		βce$^-$
		W	0.520			

(0.64 β) (0.69 γ) (0.70 β) (0.1026 γ)

†ce$^-$ per 100 β^-

**Spectrum analysed only for $E_\beta > 0.35$

R.L.Graham, J.Walker, Phys. Rev. 94, 794A (1954); *priv. comm.

β^-	55†	0.62	sl(β) (0.103 γ)
	45†	0.69	
γ		(0.069)	sl ce$^-$
		0.084	
	100†	0.103	
	≤ 2†	0.172	scin
	~4†	0.545	

$(ce_K^-\ 0.084\ \gamma)/(ce_K^-\ 0.103\ \gamma) \sim 0.01$

$(ce_L^-\ 0.084\ \gamma)/(ce_L^-\ 0.103\ \gamma) \sim 0.04$

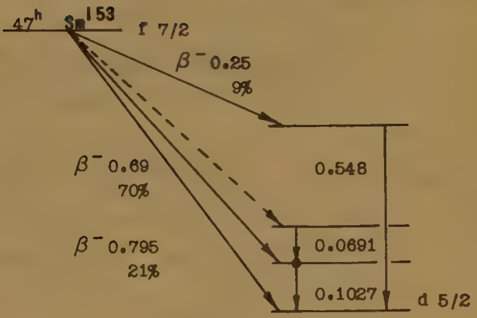
N.Marty, Compt. rend. 238, 2516 (1954).

Sm^{153} 62 91 47^h			Sm(pile n)	$\gamma\gamma$ scin
	γ	0.070	$\alpha_K = 3.8$ M1 + E2	x/γ
		0.102	$\alpha_K = 1.1$ $\tau = 3.4 \times 10^{-9}$s	

0.070 γ precedes 0.102γ

F.K.McGowan, Phys. Rev. 93, 163 (1954).

β^-	9%	0.26	Sm^{152}(pile n)		sπ
	70%	0.685			
	21%	0.795			
			α_K	K/L	sπ ce$^-$
γ		0.0691		4	
		0.1027	0.6	6	M1 + E2
		0.548	0.008	6	



M.R.Lee, R.Katz, Phys. Rev. 93, 155 (1954); 92, 848A (1953).

Eu No α activity $\tau > 8 \times 10^{15}$y for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf. 9a, 701 (1954).

	Eu$(\alpha,\alpha'\gamma)$	$E_\alpha = 3.4$	
γ	0.081		scin
	0.108		
	0.189		

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399 (1954).

Resonances	Eu(n)		$E_n = 10$ to 20 ev
	10.6 ev	15.1	cryst s
	11.8	~19.5	
	12.8		

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 93, 1292 (1954).

Eu^{152} 63 89 13^y	γ		Eu^{151}(pile n)	sπ
		0.1212		ce$^-$(Sm)
		0.2436		ce$^-$(Gd)
		0.344		ce$^-$(Gd)
		0.98		a

Eu^{151} impurity in Sm^{152} sample

M.R.Lee, R.Katz, Phys. Rev. 93, 155 (1954); 85, 1038 (1952).

γ	0.1218	sπ ce$^-$
	0.2443	

Assignment by comparison of fission Eu and normal Eu activities

E.L.Church, M.Goldhaber, Phys. Rev. 95, 626A (1954).

Eu^{152} γ (0.122) $\tau = 1.40\times10^{-9s}$ scin
63 89
13^{y}

A.W.Sunyar, Phys. Rev. 95, 626A (1954).

Resonances Eu(n) E_n = 0.08 to 10 ev

	E_0 (ev)	σ_0	Γ (ev)	
0.24*	(−0.011)			cryst s
0.19*	0.327	4000	0.086	
0.11*	0.461	23200	0.096	
0.06*	1.055	3100	0.11	
		$\sigma_0\Gamma^2$	$\sigma_0\Gamma$	
	2.73		40	
~0.06*	3.35	110		
~0.06*	7.36	130		

*Yield ratio 9.2^{h}Eu/13^{y}Eu

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 93, 1292 (1954); *R.E.Wood, Phys. Rev. 95, 453 (1954).

Eu^{154} β^- 0.71 Eu^{153} (pile n) sπ
63 91 γ 0.1224 sπ ce$^-$(Gd)
16^{y} 1.17 a

Eu^{153} impurity in Sm^{154} sample

M.R.Lee, R.Katz, Phys. Rev. 93, 155 (1954); 85, 1038 (1952).

γ 0.1234 sπ ce$^-$
0.2477

Assignment by comparison of fission Eu and normal Eu activities

E.L.Church, M.Goldhaber, Phys. Rev. 95, 626A (1954).

Resonances Eu(n) E_n = 0.08 to 10 ev

E_0 (ev)	$\sigma_0\Gamma^2$	$\sigma_0\Gamma$	
1.76		50	cryst s
2.46	90		
3.84	70		
6.25		180	
8.98	100		

No yield of 9.2^{h}Eu at these resonances*

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 93, 1292 (1954); *R.E.Wood, Phys. Rev. 95, 453 (1954).

Eu^{155} β^- 84% 0.152 sπ
63 92 16% 0.252 Sm^{154}(pile n, $\gamma\beta^-$)
1.7^{y} γ 0.0187 sπ ce$^-$
0.0593
0.0858 K/L = ~4
0.1045 K/L = 6.1
0.1309
0.1368

M.R.Lee, R.Katz, Phys. Rev. 93, 155 (1954).

γ 0.0598 sπ ce$^-$
0.0863
0.1051

No 0.130 γ

E.L.Church, M.Goldhaber, Phys. Rev. 95, 626A (1954).

Eu^{156} τ 14^d *1* Eu^{155}(n,γ)
63 93
14^{d}

E.L.Church, M.Goldhaber, Phys. Rev. 95, 626A (1954).

Gd Gd(α,$\alpha'\gamma$) E_α = 3.0
γ 0.082 scin
0.124

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 906 (1954).

Capture γ's Gd(n,γ) s pr

0.3†	5.61	0.5†	6.73
0.2†	5.87	0.03†	7.36
0.2†	6.41	0.03†	7.78

Also graph E_γ = 3 to 8
†Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

Gd^{153} γ 0.0694 Gd(n,γ); sπ ce$^-$
64 89 0.0973
236^{d} 0.1031

E.L.Church, M.Goldhaber, Phys. Rev. 95, 626A (1954).

Gd^{156} Capture γ's Gd(n,γ) sπ ce$^-$
64 92 0.0888
stable 0.1987

Assigned by comparison with target depleted in Gd^{157} by long neutron bombardment

E.L.Church, M.Goldhaber, Phys. Rev. 95, 626A (1954).

Gd^{158} Capture γ's Gd(n,γ) sπ ce$^-$
64 94 0.0791
stable 0.1817

Assigned by comparison with target depleted in Gd^{157} by long neutron bombardment

E.L.Church, M.Goldhaber, Phys. Rev. 95, 626A (1954).

Gd^{159} β^- ~0.9 Gd(pile n)
64 95 ~1.1 $\alpha\beta\gamma$
18.0^{h} γ 0.0575 sπ ce$^-$
0.364

(~0.9β)(0.36γ) (~1.1β)(0.058γ)
No (K x ray)(0.36γ)

W.C.Jordan, J.M.Cork, S.B.Burson, Phys. Rev. 92, 315 (1953).

Gd^{161} τ 3.73^m *10* Gd(pile n)
64 97 β^- ~1.6 a
3.6^{m} γ 0.102 scin
0.165 ?
0.316
0.360
x K x ray (Tb) crit a

(0.102γ)(0.316γ) (0.36γ)(K x ray)
No (0.316γ)(0.36γ)
(β)(all γ's and K x ray)

W.C.Jordan, J.M.Cork, S.B.Burson, Phys. Rev. 92, 315 (1953).

Tb^{149} 65 84 4.1^h	$\alpha/\epsilon > 2 \times 10^{-3}$		Gd(75-Mev p)	chem

M.A.Rollier, J.O.Rasmussen, Jr., Rend. acad. nazl. Lincei 14,526(1953); UCRL-2079.

Tb^{154} 65 89 17.2^h	τ	17.2^h	Eu(38-Mev α)	chem
	β^+	1.66		$s\pi\sqrt{2}$
		2.75		
	ce^-	0.188		
		0.233		
		0.281		
		0.322		
		0.374		
		0.517		
		0.549		

M.A.Rollier, J.O.Rasmussen, Jr., Rend. acad. nazl. Lincei 14,526(1953); UCRL-2079.

Tb^{159} 65 94 stable	No α activity	$\tau > 5\times10^{16y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf.9a,701(1954).

Tb^{160} 65 95 73^d	β^-	60%	0.590	s βce^-
		40%	0.850	s

L.Ya Shavtavalov, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 503 (1953); Chem. Abstr. 48-2489d(1954).

		K/L		$s\pi$ ce^-
γ	0.0863	0.9	$L_1 \ll L_2 \sim L_3$	
	0.0934			
	0.1961	~3		
	0.2148	>2		
	0.2976	>5		
	0.391			
	0.759			
	0.873	~5		
	0.960	~5		
	1.174			
	1.265			

(0.86 β) (0.086γ, 0.873γ, 0.960γ) $\mathrm{a}\beta\gamma$ scin
(0.52 β) (0.086γ, 0.196γ, 0.215γ, 0.298γ)
(0.52 β) (0.873γ, 0.960γ, 1.17γ)
(0.086γ)(0.215γ, 0.298γ, 0.873γ, 1.17γ)
(0.196γ)(0.086γ, 0.215γ, 0.759γ)
(0.215γ)(0.759γ, 0.960γ)
(0.298γ)(0.873γ, 0.960γ)
No 0.396 β No 0.176 γ

S.B.Burson, W.C.Jordan, J.M.LeBlanc, Phys. Rev. 94, 103 (1954).

$\mathrm{Tb}^?$ 65 $\sim17^h$	τ	$\sim17^h$	Eu(38-Mev α)	chem
	β^-	2.34		$s\pi\sqrt{2}$

M.A.Rollier, J.O.Rasmussen, Jr., Rend. acad. nazl. Lincei 14,526(1953); UCRL-2079.

$\mathrm{Tb}^?$ 65 $>17^h$	τ	$>17^h$	Eu(38-Mev α)	chem
	β^+	3.1		$s\pi\sqrt{2}$
	ce^-	0.08	0.15	
		0.09	0.21	
		0.13		

M.A.Rollier, J.O.Rasmussen, Jr., Rend. acad. nazl. Lincei 14,526(1953); UCRL-2079.

Dy	No α activity	$\tau > 5\times10^{16y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf.9a,701(1954).

	Dy($\alpha,\alpha'\gamma$)	$E_\alpha = 3.4$	
γ	0.076		scin
	0.166		

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399 (1954).

Dy^{161} 66 95 stable	I	7/2?	8
	$\mu(\mathrm{Dy}^{161})/\mu(\mathrm{Dy}^{163}) \sim 1$		

K.Murakawa, T.Kamei, Phys. Rev. 92,325(1953).

Dy^{163} 66 97 stable	I	7/2?	8

K.Murakawa, T.Kamei, Phys. Rev. 92,325(1953).

Dy^{165} 66 99 1.2^m	β^-	(0.84) (calc)		Dy(pile n); $s\pi$ ppl
	γ	0.108	$\alpha_K \sim 4$	scin, $s\pi$ ce^- ppl
			$K : L_2 : L_3 : M : N$ $3 : 10 : 10 : 5 : 1.5$	
		0.16		
		0.36		
		0.515		

(0.16γ) (0.36γ)

W.C.Jordan, J.M.Cork, S.B.Burson, Phys. Rev. 92, 1218 (1953); 91, 497A(1953).

γ	0.106	K/LM = 0.15	sl ce^- Dy(slow n)

G.Weber, Z.Naturf. 9a, 115 (1954).

Dy^{165} 66 99 2.32^h	τ_2	2.38^h	Dy(slow n)

E.R.Mayquez, Anales real soc. españ. fís. y quím. 50A, 95 (1954).

τ_2	2.4^h		Dy(slow n)
γ	0.0927	K/LM = 2.7	sl ce^-

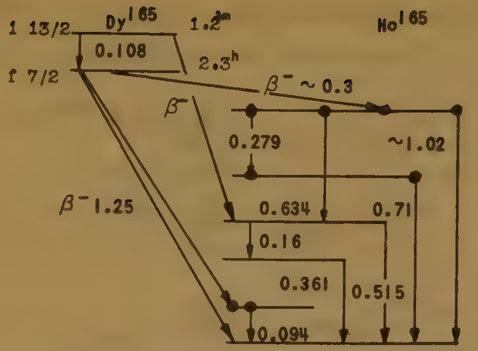
G.Weber, Z.Naturf. 9a, 115 (1954).

γ	0.0944		scin, $s\pi$ ce^- ppl
		$K : L : M$ $60 : 7.8 : 1.5$	
	0.279	K/L > 5	
	0.361	K/L > 5	
	0.634		
	0.71		
	~1.02		

(~1.2β) (0.094γ) (~0.3β) (all other γ's)
(0.28γ) (0.71γ) (0.63γ) (0.36γ) No other $\gamma\gamma$

(CONTINUED)

Dy^{165}
66 99



W.C.Jordan, J.M.Cork, S.B.Burson, Phys. Rev. 92, 1218 (1953).

Ho^{160}
67 93
23^m

τ $\sim 22^m$ Dy(8.5-Mev p) chem
Not produced by Er(22-Mev p), Ho^{165}(22-Mev p)
Not d $3.6^h Er^{161}$

T.H.Handley, Phys. Rev. 94, 945 (1954).

Ho^{161}
67 94
2.5^h

τ 2.5^h d 3.6^hEr chem
Er(24-Mev p), Dy(8.5-Mev p)
γ 0.090 scin
0.17
x K x ray

T.H.Handley, Phys. Rev. 94, 945(1954); 93, 524 (1954).

Ho^{162}
67 95
5.0^h

τ 5.0^h Dy(8.5-Mev p) chem
γ 0.19 scin
0.71
0.95
x K x ray
No 0.511 γ
Not produced by Ho^{165} (22.5-Mev p), Er(p)
No 65^d activity found

T.H.Handley, Phys. Rev. 94, 945 (1954).

Ho^{163}
67 96
?

τ $< 10^m$ or $> 20^y$ d 75^mEr chem
Dy(20-Mev p), Er(p) chem
No 5^d activity

T.H.Handley, Phys. Rev. 94, 945 (1954); 92, 1260 (1953).

Ho^{164}
67 97
36.7^m

τ 36.7^m Ho^{165}($\leq$ 22-Mev γ)
β^- ~ 0.90 sl
0.99
γ 0.037 sl ce^-, scin
0.046 (also K x ray)
0.073
0.090
(0.046 γ) (0.037 γ, 0.046 γ, 0.073 γ)
β^- (0.090 γ, K x ray)

H.N.Brown, F.B.Smith, R.A.Becker, Phys. Rev. 95, 626A (1954).

Ho^{164}
67 97
36.7^m

τ 41^m Dy(p), Ho^{165}(p), Er(p) chem
β^- 0.9 a
x K x ray ? scin

T.H.Handley, Phys. Rev. 94, 945 (1954).

Ho^{165}
67 98
stable

No α activity $\tau > 6x10^{16y}$ for $1.5 < E_\alpha < 2.5$

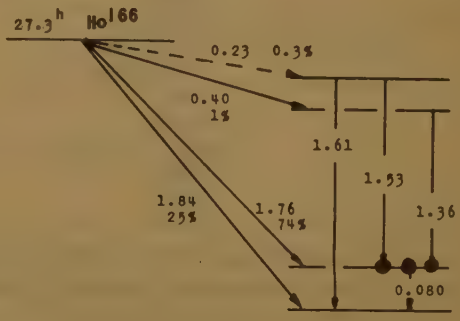
W.Porschen, W.Riezler, Z.Naturf. 9a, 701 (1954).

$Ho^{165}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.4$
γ 0.093 scin
0.205

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399 (1954).

Ho^{166}
67 99
27.3^h

β^- ~0.3% (0.23)
1% (0.40)
74% (1.76) $\beta\gamma$
25% (1.84)
γ 85† 0.080 $\alpha_K = 1.9$ K/L = 0.25 scin
10† 1.36
2† 1.53
~1† 1.61
(0.080 γ)(1.36 γ, 1.53 γ)
No 0.170 γ (<0.9†) No 1.44 γ (<2†)



A.W.Sunyar, Phys. Rev. 93, 1345 (1954).

Ho^{166}
67 99
$>30^y$

Resonances Ho^{165}(n) E_n = 0.1 to 30 ev
3.96 $\sigma_0\Gamma^2 \sim 77$ cryst s
12.8 $\sigma_0\Gamma^2 \sim 300$
19
22
39

H.L.Foote, Jr., H.H.Landon, V.L.Sailor, Phys. Rev. 92, 656(1953); 90,362A(1953).

Resonances Ho^{165}(n) E_n = 2 to 100 ev
35.9 ev 52.3 chopper
37.9 55.3
40.3 $\left\{\begin{array}{l}\sigma_0 \sim 7800\\ \sigma_0\Gamma^2 = 66\end{array}\right.$ 66.4
48.3
Twelve other resonances observed

V.E.Pilcher, R.S.Carter, A.Stolovy, Phys. Rev. 95, 645A (1954); verbal report.

Er No α activity $\tau > 10^{17y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf. 9a, 701(1954).

Er(α,$\alpha'\gamma$) $E_\alpha = 3.4$
γ 0.079 scin
0.174

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399 (1954).

Er^{160} τ 30^h Ta^{181}(350-Mev p) ms
68 92
30^h M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

Er^{161} τ 3.5^h Ta^{181}(350-Mev p) ms
68 93
3.6^h M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

τ 3.6^h Er(17-Mev p) chem
Not by Ho(p), Er(n,γ)
γ 0.065 scin
0.195?
0.824
1.120
No 0.511 γ

T.H.Handley, E.L.Olson, Phys. Rev. 93, 524 (1954).

Er^{163} τ 75^m Ho^{165}(19-Mev p) chem
68 95 γ 0.43 scin
75^m 1.10
No β^+ (<1%)
τ of daughter $< 10^m$ or $> 20^y$ chem
Mass assignment from 19-Mev threshold

T.H.Handley, E.L.Olson, Phys. Rev. 92,1260 (1953); 94, 945 (1954).

Tm^{165} τ 29^h Ta^{181}(350-Mev p) ms
69 96
24.5^h M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

τ 24.5^h Er(>12-Mev p) chem
p 9.9^hEr chem
γ 0.205 scin
0.308
1.16
1.38
No β^+ (< 1%)

T.H.Handley, E.L.Olson, Phys. Rev. 92,1260 (1953).

Tm^{166} τ 7.7^h ms
69 97
7.7^h M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

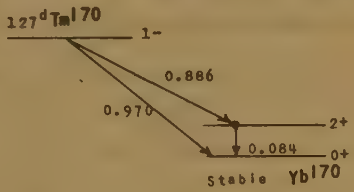
Tm^{167} τ 9.6^d ms
69 98
9.6^d M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

Tm^{167} τ 9.4^d d 18.5^mYb chem
69 98
9.6^d T.H.Handley, E.L.Olson, Phys. Rev. 94,968 (1954).

Tm^{168} τ 87^d Tm^{169}(24-Mev p) chem
69 99
87^d T.H.Handley, E.L.Olson, Phys. Rev. 94, 968 (1954).

Tm^{169} No α activity $\tau > 5\times10^{16y}$ for $1.5 < E_\alpha < 2.5$
69 100
stable W.Porschen, W.Riezler, Z.Naturf. 9a,701(1954).

Tm^{170} β^- 22% 0.886 Tm^{169}(pile n); sl $\beta\gamma$
69 101 78% 0.970 sl
127^d
γ 0.0841 sl ce$^-$
Both F-K plots linear



A.V.Pohm, W.E.Lewis, J.H.Talboy, E.N.Jensen, Phys. Rev. 95, 1523 (1954).

γ (0.084) $\alpha_K = 1.6$ x/γ scin
Electromagnetic spectrum given for source thickness from 0 to 1.0 g/cm^2

K.Linden, N.Starfelt, Arkiv Fysik 7,109(1954).

Resonance Tm^{169}(n) $E_n = 0.1$ to 30 ev
3.92 $\sigma_0\Gamma^2 \sim 380$ cryst s
14.8
17.6

H.L.Foote, Jr., H.H.Landon, V.L.Sailor, Phys. Rev. 92, 656(1953); 90,362A(1953).

Yb No α activity $\tau > 10^{17y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf. 9a,701(1954).

Yb(α,$\alpha'\gamma$) $E_\alpha = 3.4$
γ 0.081 scin
0.114
0.180

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399; 93, 351 (1954).

Yb^{166} τ 58^h ms
70 96
58^h M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

Yb^{167} 70 97 18.5^m

τ	18.5^m	Tm^{169} (19.0-Mev p)	chem
		D 9.6^d Tm	scin
γ	0.118		scin
	0.18 ?		
	0.33 ?		
x	K x ray		

No 73^m Yb or Tm activity

T.H.Handley, E.L.Olson, Phys. Rev. 94, 968 (1954).

Yb^{169} 70 99 31.8^d

τ 33^d Tm^{169} (24-Mev p) chem

T.H.Handley, E.L.Olson, Phys. Rev. 94, 968 (1954).

τ 32^d ms

M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

Lu No α activity $\tau > 10^{17y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf. 9a,701(1954)

Lu(α,$\alpha'\gamma$) $E_\alpha = 3.4$

γ	0.113	scin
	0.183	
	0.248	

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399; 93, 906 (1954).

Resonances Lu(n) E_n = 0.03 to 35ev cryst s

E_o (ev)	$\sigma_o\Gamma^2$
0.142	1.4
1.57	0.9
2.62	6
4.80	21
5.30	45
11.4	58
14.4	(560)*
20.6	
24	
31	

*2 or more unresolved resonances

H.L.Foote, H.H.Landon, V.L.Sailor, Phys.Rev. 92, 656(1953); 90, 362A(1953).

Lu^{176} 71 105 $2.4x10^{10y}$

τ_2		$4.56X10^{10y}$ 30		
β^-		0.43		pc
γ		(0.089)		pc
	100†	0.19	E2*	scin
	100†	0.31	E2 or E1*	

(0.089 γ) (0.19 γ, 0.31 γ) (0.19 γ)(0.31 γ)

$\epsilon/\beta^- = 0.03$ *From ce^-/β pc

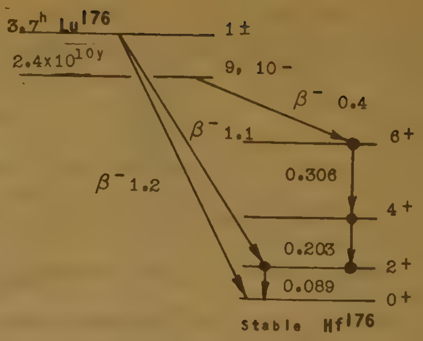
D.Dixon, A.McNair, S.C.Curran, Phil. Mag. 45, 683 (1954).

τ_2		$2.35x10^{10y}$ 25*	
γ	0.6†	0.089	scin
	3.3†	0.203	
	3.7†	0.306	

$\epsilon/\beta^- < 0.1$ assuming x rays from conversion of E2 γ's

(CONTINUED)

Lu^{176} 71 105



J.A.Arnold, Phys. Rev. 93, 743 (1954).
*priv. comm.

Hf No α activity $\tau > 2x10^{17y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf. 9a,701(1954).

Hf(α,$\alpha'\gamma$) $E_\alpha = 3.4$

γ	0.093	scin
	0.112	
	0.250	

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399 (1954); 93, 906 (1954).

Hf^{171} 72 99 16^h

γ	0.63*	Yb (56-Mev α)	chem
	1.02*		scin

*Could belong to $23.6^h Hf^{173}$

A.H.Wapstra, C.Jongejans, Physica 20,36(1954).

Hf^{173} 72 101 23.6^h

			Yb (56-Mev α)	chem
γ	100†	0.121		scin
	75†	0.299		
	w	0.63*		
	w	1.02*		
x	90†	K x ray		

*Could belong to $16^h Hf^{171}$

A.H.Wapstra, C.Jongejans, Physica 20,36(1954).

Hf^{175} 72 103 70^d

γ	0.089	K/L = 6.0	sl ce^-, pe^-
	0.113		
	0.228	K/LM = 2	
	0.318		
	0.3423	K/LM = 4.9	
	0.4305		

A.B.Burford, J.F.Perkins, S.K.Haynes, Phys. Rev. 95, 303A (1954).

γ	0.0895	K : L : M = 30 : 15 : 1.5
	0.340	K : L : M = 100 : 20 : 5
		Hf (slow n)

A.A.Bashilov, N.M.Anton'eva, B.S.Dzhelepov, A.I.Dolgentseva, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 437(1953); Chem. Abstr. 48-2489h(1954).

Hf^{178}
72 106
stable

Resonances Hf(n) $E_n = 0.04$ to 4 ev cryst s
1.095 ev
2.38 ev

E.G.Jokl, J.E.Evans, Phys. Rev. 96,849A(1954).

Resonances Hf^{177}(n) chopper

E_o (ev)	$\sigma_o\Gamma^2$	σ_o	Γ
1.08	110	~55.000	~0.045
2.34	280	>30,000	<0.10
5.7	52	> 2,400	<0.15
6.5	80	> 7,200	<0.11
8.8	55	> 3,600	<0.12
13.6	28	> 450	<0.25

Capture γ's per pile n capture = 4.1

L.M.Bollinger, S.P.Harris, C.T.Hibdon, C.O. Muehlhause, Phys. Rev. 92,1527(1953); 87,222A (1952).

Hf^{179}
72 107
stable

Resonance Hf^{178}(n) chopper
7.6 ev $\sigma_o\Gamma^2 \sim 1400$ $\Gamma < 0.26$
Capture γ's per pile n capture = 3.5

L.M.Bollinger, S.P.Harris, C.T.Hibdon, C.O. Muehlhause, Phys. Rev. 92,1527(1953); 87, 222A(1952).

Hf^{180}
72 108
5.5^h

γ $s\pi$ ce$^-$

0.0576	M3	
0.0933	E2	
0.2155	E2	$\tau < 10^{-6s}$
0.3330	E2	$\tau < 10^{-6s}$
0.4435	E2	$\tau < 10^{-6s}$

$(0.444\gamma)(0.333\gamma)(\theta)$
$(0.444\gamma)(0.216\gamma)(\theta)$ $\Delta I = 2$ for each γ

J.W.Mihelich, G.Scharff-Goldhaber, M.McKeown, Phys. Rev. 94, 794A (1954); verbal report.

Hf^{180}
72 118
stable

Resonance Hf^{179}(n) chopper
5.6 ev $\sigma_o\Gamma^2 \sim 25$ $\Gamma < 0.1$

L.M.Bollinger, S.P.Harris, C.T.Hibdon, C.O. Muehlhause, Phys. Rev. 92,1527(1953); 87, 222A(1952).

Hf^{181}
72 109
46^d

τ 46^d 4
γ (0.133) $\tau = 18.8^{\mu s}$ 5 $\beta\gamma$

H.S.Murdoch, Proc. Phys. Soc. 66A, 944(1953).

β^- 0.405 Hf(slow n) s

γ	K : L_2 : L_3 : MN*
0.1322	21 : 16 : 14 : 10
0.1352	12
0.478	1.9 : 0.4 : 0.1
0.607	0.04: ~ 0.006

*ce$^-$ per 100 β's

A.A.Bashilov, N.M.Anton'eva, B.S.Dzhelepov, A.I.Dolgentseva, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 437 (1953); Chem. Abstr. 48-2489h(1954).

Hf^{181}
72 109
46^d

Hf^{180}(pile n) γce$^-$ scin x/γ

γ	a_k	
0.132	0.48	E2
0.135	1.9	M1
0.345	0.08	
0.480	0.034	M1,E2 or E1,M2

K/LM = 4

F.K.McGowan, Phys. Rev. 93, 163 (1954).

γ $\gamma\gamma(\theta)$

	E2	M1
(0.132)	100%	
(0.135)	20%	80%
(0.345)	50%	50%
(0.480)	60%	40%

$(0.132\gamma)(0.480\gamma)(\theta)$ I = 5/2, 9/2, 7/2
$(0.345\gamma)(0.135\gamma)(\theta)$ I = 9/2, 9/2, 7/2

F.K.McGowan, Phys. Rev. 93, 471 (1954).

Ta^{180}
73 107
8.15^h

γ (0.093) $\tau = 1.39 \times 10^{-9s}$

A.W.Sunyar, Phys. Rev. 95,626A (1954).

Ta^{181}
73 108
stable

Level Ta^{181}(n,n'γ) $E_n = 1.1$
γ 0.137 scin

J.B.Guernsey, C.Goodman, Phys. Rev. 95, 636A (1954).

γ Ta^{181}(p,p'γ) $E_p = 2.0$ s ce$^-$
0.137 1
0.166 1

T.Huus, J.H.Bjerregaard, Phys. Rev. 92,1579, (1953).

γ Ta^{181}(p,p'γ) E_p = 2 to 4 scin

	0.137	I = 9/2 E2/M1 < 0.05	p,$\gamma(\theta)$
17†	0.166		
10†	0.303	I = 11/2	p,$\gamma(\theta)$

$(0.137\gamma)(0.166\gamma)$

W.I.Goldburg, R.M.Williamson, Phys. Rev. 94, 747A (1954); 95, 629A, 767 (1954).

γ's Ta^{181}(p,p'γ) $E_p = 3$ scin

100†	0.139	I = 9/2	p,$\gamma(\theta)$
100†	0.167		
80†	0.309	I = 11/2	p,$\gamma(\theta)$

J.T.Eisinger, C.F.Cook, C.M.Class, Phys. Rev. 94, 735,747A(1954).

γ Ta^{181}(p,p'γ) E_p = 1.2 to 4.5 scin
(0.137)
(0.166)
(0.303)
Excitation curves for 0.137- and 0.303-Mev levels in good agreement with theory for E2 coulomb excitation

R.Barloutaud, T.Grjebine, Compt. rend. 239, 491 (1954).

Ta^{181}
73 108
stable

γ Ta^{181}(α,α'γ) E_α = 3.4 scin
0.137
0.167
0.303

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399; 93, 351 (1954).

Level (0.480) g = +1.2 γγ(θ,H)

S.Raboy, V.E.Krohn, Phys. Rev. 95,1689(1954).

Ta^{182}
73 109
111^d

β^- 0.510* Ta^{181}(pile n); sl

γ sl ce$^-$, cryst

		α_K	α_{L1}	α_{L2}	α_{L3}	K/L
W	0.03336					
W	0.04271					
9†	0.06571		2.8	0.4	0.23	
100†	0.06774		0.17	0.07	0.07	
6†	0.08467		1.85	0.6	0.5	
46†	0.10009	1.5	0.13	1.4	1.35	
9†	0.11366	1.75	0.38	0.07		
2†	0.11640					
43†	0.15241	0.07				
14†	0.15637	small				
19†	0.17936	0.41	0.17		0.05	
9†	0.19831	0.24		0.11	0.07	
45†	0.22205	0.06	0.01			
24†	0.22927	0.16		0.05	0.03	
27†	0.26409	0.11		0.04	0.02	
	0.927					
	0.960					
	1.003					7.0
120†	1.122	0.005				6.7
8†	1.155	0.004				
56†	1.189	0.006				6.5
115†	1.222	0.003				6.0
58†	1.231	0.003				
	1.298					6.6
	1.375					
	1.437					
	1.454					

*Evidence for at least two lower energy β's
Decay scheme proposed

F.Boehm, P.Marmier, J.W.M.DuMond, Phys. Rev. 95, 864 (1954).

γ (0.100) $\tau = 1.3\times10^{-9}$s γ(ce$^-$)
(1.29) $\tau = 1.0\times10^{-9}$s βγ

A.W.Sunyar, Phys. Rev. 93, 1122 (1954); 95, 626A (1954).

(0.100 γ)(1.121 γ, 1.188 γ)
No (0.100 γ)(1.223 γ)

J.W.Mihelich, Phys. Rev. 95, 626A (1954).

Capture γ's Ta^{181}(n,γ)) s pr

1 †	4.84	0.3†	5.57
0.5†	5.05	0.3†	5.78
0.5†	5.21	0.7†	6.07
0.3†	5.38		

Also graph E_γ = 2.5 to 8.0
B_n(Ta^{181}) = 6.0 from Ta^{181}(d,p)
†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025 (1953).

Ta^{182}
73 109
111^d

Resonances Ta^{181}(n) E_n = 5 to 5000ev time of flight

E_0 (ev)	$\sigma_0\Gamma^2$
4.1	55.4
6.1?	
10.2	48
13.7	11
20.0	10.3
24.0	39
35.1	200
38.2	280

E.Melkonian, W.W.Havens, Jr., L.J.Rainwater, Phys. Rev. 92, 702(1953).

Resonances Ta^{181}(n) E_n = 0.3 to 50ev crystal s

E_0 (ev)	$\sigma_0\Gamma^2$
4.29	59
10.36	32
13.9	12
20.7	7
24.2	27
36.7	~250
39.4	~180

R.L.Christensen, Phys. Rev. 92,1509(1953).

Ta^{183}
73 110
5^d

τ 5.2^d Ta^{181}(n,γ)(n,γ)
β^- 0.56 sl
γ sl, cryst

10.3%	0.04097	M1			
61.4%	0.04648	M1	9.8%	0.16233	M1
41.7%	0.05259	M1	0.4%	0.19264	M1
2.5%	0.08292	(M1)	0.4%	0.20327	M1
14.0%	0.08470	M1	1.4%	0.20506	M1
31.9%	0.09907	E2	1.1%	0.20881	M1
1.5%	0.10194	M1	5.4%	0.20987	E2
0.5%	0.10314	(E2)	10.0%	0.24426	E2
45.7%	0.10793	M1	35.6%	0.24605	M1
2.9%	0.10973	(M1)	5.4%	0.29171	E2
0.25%	0.12038	M1	8.8%	0.31303	M1
6.4%	0.14412	M1	12.0%	0.35404	M1
4.4%	0.16053	E2	0.8%	0.36560	(M1)
18.2%	0.16136	M1	0.9%	0.40658	(E2)

J.J.Murray, P.Snelgrove, P.E.Marmier, J.W.M. DuMond, Phys. Rev. 96,858A (1954); 92, 202 (1954).

W

Capture γ's W(n,γ) s pr

2.4†	4.67	0.3†	6.02?
0.6†	4.94	3.8†	6.182*
2.3†	5.14	0.3†	6.40
3.4†	5.245	0.1†	6.73
2.4†	5.304	0.3†	7.42**
0.3†	5.77		

Also graph E_γ = 3 to 7.5
*W^{183}? **W^{184}?
W(γ,n) thresholds known at 6.3 and 7.2
†Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

W^{181}
74 107
140^d

γ 0.1365 K/L ~8 W^{180}(pile n)
0.1525 K/L ~8 sl ce$^-$

γγ?
No other γ (< 10^{-6} of K x rays) scin

J.M.Cork, W.H.Nester, J.M.LeBlanc, M.K.Brice, Phys. Rev. 92, 119 (1953).

W^{182}
74 108
stable

γ $W^{182}(p,p'\gamma)$ $E_p = 2.5$
0.101 scin

C.L.McClelland, M.Mark, C.Goodman, Phys. Rev. 93, 904 (1954).

γ $W(p,p'\gamma)$ $E_p = 1.75$
0.102 s ce^-

T.Huus, J.H.Bjerregaard, Phys. Rev. 92,1579, (1953).

W^{183}
74 109
stable

γ $W^{183}(p,p'\gamma)$ $E_p = 2.5$
0.103 scin

C.L.McClelland, M.Mark, C.Goodman, Phys. Rev. 93, 904 (1954).

W^{184}
74 110
stable

γ $W^{184}(p,p'\gamma)$ $E_p = 2.5$
0.112 scin

C.L.McClelland, M.Mark, C.Goodman, Phys. Rev. 93, 904 (1954).

γ $W(p,p'\gamma)$ $E_p = 1.75$
0.113 s ce^-

T.Huus, J.H.Bjerregaard, Phys. Rev. 92,1579, (1953).

W^{186}
74 112
stable

γ $W^{186}(p,p'\gamma)$ $E_p = 2.5$
0.124 scin

C.L.McClelland, M.Mark, C.Goodman, Phys. Rev. 93, 904 (1954).

γ $W(p,p'\gamma)$ $E_p = 1.75$
0.124 s ce^-

T.Huus, J.H.Bjerregaard, Phys. Rev. 92,1579, (1953).

W^{187}
74 113
23.9^h

$(0.480\gamma)(0.072\gamma, 0.134\gamma, 0.206\gamma)$ scin
$(0.134\gamma)(0.072\gamma, 0.480\gamma)$

E.Germagnoli, A.Malvicini, L.Zappa, Nuovo Cim. 10, 1388 (1953).

Re

No α activity $\tau > 2\times10^{16y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf. 9a,701(1954).

γ $Re(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
0.130 scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

Re

Resonances Re (n) $E_n = 0.003$ to 10^4 ev
time of flight

E_0 (ev)		
2.18*	$\sigma_0 = 5700$	$\Gamma = 0.09$
4.40**	$\sigma_0 = 2000$	$\Gamma = 0.05$
	$\sigma_0\Gamma^2$	
5.92	2.88	
7.18	15.0	
11.3**	29.8	
13.1	19.0	
17.7	44.7	
21.1	19.4	

*Re^{185} **Re^{187}

E.Melkonian, W.W.Havens, Jr., L.J.Rainwater, Phys. Rev. 92, 702 (1953).

Re^{186}
75 111
3.8^d

β^- 0.3 $\beta\gamma$ sl
0.926 F-K plot linear $\beta\gamma$ sl
1.063 F-K plot linear sl
$(0.926\beta)(0.137\gamma)$

L.Koerts, Phys. Rev. 95, 1358 (1954).

β^- 0.93 $\Delta I = 2$, yes shape* sm
1.064 F-K plot linear
*After subtraction of 1.064-Mev component

D.Gass, L.Killion, F.T.Porter, Phys. Rev. 95, 627A (1954).

β^- 27% ~0.9 s
73% 1.06
γ 0.08? s ce^-
0.1234
0.1383 K : L : M = 0.9 : 3 : 1
0.164?

N.M.Anton'eva, A.A.Bashilov, B.S.Dzhelepov, L.S.Chervinskaya, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 507 (1953); Chem. Abstr. 48-2490b (1954).

$\beta\gamma(\theta)$ isotropic
$(0.627\gamma)(0.137\gamma)(\theta)$ I = 2, 2, 0

J.P.Hurley, P.S.Jastram, Phys. Rev. 95,627A (1954).

Re^{187}
75 112
$\sim5\times10^{10y}$

τ $\sim5\times10^{10y}$
From radiogenic Os^{187} present in mineral of age $\sim5\times10^8$ years ms

H.Hintenberger, W.Herr, H.Voshage, Phys. Rev. 95, 1690, 1691 (1954).

τ $< 10^{11y}$ 0.14 counts/min/cm²
β^- < 0.008 a

A.D.Suttle, Jr., W.F.Libby, Phys. Rev. 95,866 (1954).

Re^{188}
75 113
16.9^h

γ (0.155) $\tau = 6.5\times10^{-10}$

A.W.Sunyar, Phys. Rev. 95, 626A (1954).

Re^{188} 75 113 16.9^h	One or both principal β groups possibly exhibit nonallowed shape			

D.Guss, L.Killion, F.T.Porter, Phys. Rev. 95, 627A (1954).

Re^{191}? 75 114 9.8^m	τ	9.8^m	Os(26-Mev n)	chem
	β^-	1.8		a

A.H.W.Aten, Jr., G.D.de Feyfer, Physica 19, 1143 (1953).

Os		$Os(\alpha,\alpha'\gamma)$	$E_\alpha = 3.0$	
	γ	0.157		scin
		0.180		
		0.188		
		0.202		

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

Os^{189} 76 113 stable	I	3/2	OsO_4	I
	μ	+0.65066		
	$\nu(Os^{189})/\nu(Cl^{35}) = 0.79190$			$TiCl_4$

H.R.Loeliger, L.R.Sarles, Phys. Rev. 95, 291 (1954).

Os^{191} 76 115 15^d	γ		Os(pile n)	scin
		0.129	$\alpha_K = 2.1$ M1 + E2	x/γ
	No $\beta(0.129\gamma)$, no $\beta(ce^-\ 0.129\gamma)$			

F.K.McGowan, Phys. Rev. 93, 163 (1954).

Os^{193} 76 117 31^h	β^-	w 0.6		$\beta(ce^-)$ scin
		w 0.82		
		w 0.96		
		w 1.03		
		1.10		scin
	γ	(0.073)	$\tau = 6.0\times10^{-9}$s	sl ce^-
		(0.139)	$\tau < 2\times10^{-9}$s	sl $\beta(ce^-)$
		(0.251)?		
		(0.281)	$\tau < 2\times10^{-9}$s	
		(0.321)		
		(0.460)		
		(0.558)?		
	No 0.106γ No 0.328γ			

H.de Waard, Physica 20, 41 (1954).

Ir		$Ir(\alpha,\alpha'\gamma)$	$E_\alpha = 3.4$	
	γ	0.133		scin
		0.219		
		0.360		

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 94, 1399; 93, 906 (1954).

Ir^{188} 77 111 42^h	γ	0.156	d 10.3^dPt; sl ce^-	

R.A.Naumann, Phys. Rev. 96, 90 (1954).

Ir^{191} 77 114 6.9^s	τ_1	6.9^{s*}	d 15^dOs* Pt($\leq$48-Mev n) Ir($\sim$15-Mev n)	
	γ	0.125	$\alpha_K \sim 1.5$	scin
	No 5.6 γ			

F.D.S.Butement, A.J.Poë, Phil. Mag. 45, 31, 1090 (1954); * M.Goldhaber, ibid.

Ir^{191} 77 114 stable	I	3/2		s
	μ	+0.2		
	Q	+1.5		

W. von Siemens, Ann. Physik 13,136 (1953).

Ir^{192} 77 115 1.4^m	τ_1	1.45^m	Ir(slow n)	

G.Weber, Z.Naturf. 9a, 115 (1954).

β^-	~0.1%		Ir(slow n);	a
γ IT	99.9%	0.056	$\alpha \geq 1000$	s ce^-
No continuous ce^-	($<$ 3%)			a
No continuous γ	($<$ 0.1%)			a

G.Weber, A.Flammersfeld, Z. Naturf. 8a, 580, (1953).

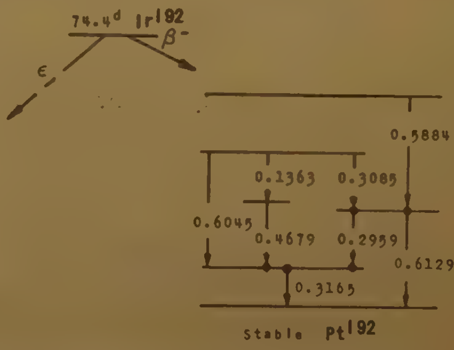
γ	0.0574	$\alpha_L \sim 750$	scin
Ir L x ray			pc
Continuum $\leq$ 50 kev attributed to bremsstrahlung			

J.P.Mize, J.W.Starner, M.E.Bunker, Phys. Rev. 95, 627A (1954).

Ir^{192} 77 115 74.4^d	γ	0.9†	0.788	scin
		1.9†	0.883	
		w	0.92 ?	
		0.4†	1.080	
		0.07†	1.210	
	E_{d1s}(Ir-Pt) = 1.49 ± 0.02			4π scin
	†Percent of the 0.605 γ + 0.613 γ peak			

R.W.Pringle, W.Turchinetz, H.W.Taylor, Phys. Rev. 95, 115 (1954); 87, 930 (1952).

$(0.296\gamma)(0.309\gamma)(0.317\gamma)$	4π scin
$(0.468\gamma)(0.317\gamma)$	
$(0.588\gamma)(0.613\gamma)$	



D.C.Lu, M.L.Wiedenbeck, Phys. Rev. 94, 501 (1954).

Ir^{193}	I		3/2		s
77 116	μ		+0.2		
stable	Q		+1.5		

W. von Siemens, Ann. Physik 13,136(1953).

Ir^{194}	γ	100†	0.32		scin
77 117		22†	0.61		
19^h		10†	1.18		
		5†	1.45	Pt(≤28-Mev γ); Ir(pile n)	
		1.2†	~1.8	Pt(48-Mev n)	chem

F.D.S.Butement, A.J.Poë, Phil. Mag. 45, 31 (1954).

Ir^{195}	τ	2.3^h	Pt(48-Mev n)	chem
77 118			Pt(≤28-Mev γ)	
2.3^h	β^-	1.2		$a\beta\gamma$
		2.1		a
	γ	0.42		scin
		0.66		
		0.88		
		>1.0		

$(1.2\beta)(\gamma)$; no $(2.1\beta)(\gamma)$

$a\beta\gamma$ indicates another lower energy β

F.D.S.Butement, A.J.Poë, Phil. Mag. 45,31 (1954).

$\mathrm{Ir}^{196?}$	τ	9.7^d	Pt(48-Mev n)	chem
77 119			not Pt(≤28-Mev γ)	
9.7^d	β^-	0.08		a
	γ	0.58		scin
		0.76	probably double	
		~1		

F.D.S.Butement, A.J.Poë, Phil. Mag. 45,31 (1954).

Ir^{197}	τ	7^m	Pt(≤28-Mev γ)	chem
77 120	β^-	<1.6	not Pt(48-Mev n)	
7^m		1.6		a
	γ	1.8		scin
	$(1.6\beta)\gamma$			$a\beta\gamma$

F.D.S.Butement, A.J.Poë, Phil. Mag. 45, 31 (1954).

Ir^{198}	τ	50^s	Pt(48-Mev n)	
77 121			not Pt(≤28-Mev γ)	
50^s	β^-	3.6		a
	γ	0.78		scin
	$(3.6\beta^-)(0.78\gamma)$			$a\beta\gamma$

Assignment supported by large E_{dis}

F.D.S.Butement, A.J.Poë, Phil. Mag. 45, 31 (1954).

Pt		Pt(p,p'γ)	$E_p = 3.0$	
	γ	0.212		scin
		0.240 ?		
		0.333		

C.M.Class, C.F.Cook, J.T.Eisinger, Phys. Rev. 94, 744, 747A (1954).

Pt		Pt(p,p'γ)	$E_p = 2.46$	scin
	γ	0.215		
		0.330		

C.L.McClelland, C.Goodman, Phys. Rev. 94, 1437A (1954).

	Pt(α,$\alpha'\gamma$)	$E_\alpha = 3.0$	
γ	0.213		scin
	0.328		

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

Capture γ's		Pt(n,γ)	s pr
	1.8†	5.24	
	1.1†	6.07	
	0.2†	7.26	
	0.3†	7.92	

Also graph $E_\gamma = 3$ to 8

$B_n(\mathrm{Pt}^{194?}) = 6.1$; $B_n(\mathrm{Pt}^{195?}) = 8.1$

Both values from Pt(γ,n) and Pt(d,p)

†Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

Pt^{188}	τ	10.3^d	Ir(50-Mev p)	chem
78 110			p 42^h Ir	chem
10.3^d	ce$^-$	0.043		sl ce$^-$
		0.053		
		0.114		
		0.180		
	x	Ir K x rays		crit a

R.A.Naumann, Phys. Rev. 96, 90 (1954); 94, 794A (1954).

Pt^{190}	?τ	$\sim 10^{12y*}$	ppl
78 112			
$\sim 10^{12y}$	α	3.3	

*Based on 0.012% abundance for Pt^{190}

W.Porschen, W.Riezler, Z.Naturf. 9a,701(1954).

Pt^{191}	τ	2.90^d 5			Pt^{190}(pile n)	
78 113	γ	0.0737 ?				sπ ce$^-$
3.0^d		0.0826	$L_1L_2/L_3 = 1.8$			
			K/L_1		K/L_1	
		0.0964	~2	0.360	~7	
		0.1296	~3	0.409	> 10	
		0.1723	~5	0.456	~9	
		0.1784		0.539	~7	
		0.2197		0.550		
		0.2684		0.623		
		0.3509	~9			

No 0.042 γ, 0.062 γ, 0.125 γ

(0.172 γ) (0.082 γ, 0.096 γ, 0.178 γ)

No (0.172 γ) (≳ 0.350γ)

J.M.Cork, M.K.Brice, L.C.Schmid, G.D.Hickman, H.Nine, Phys. Rev. 94, 1218 (1954).

Pt^{191}	γ		0.042	0.220	sπ/2 ce$^-$
78 113			0.082	0.268	
3.0^d			0.096	0.350	
			0.1296*	0.360	
			0.158 ?	0.409	
			0.172	0.456	
			0.179	0.540	
			0.188*	0.62	

No 0.125 γ* Ir(d)

E.P.Tomlinson, R.A.Naumann, J.W.Mihelich, Phys. Rev. 94, 794A(1954); * verbal report.

γ	0.0825	$L_1:L_2:L_3 = 10:18:16$		
	0.0965	$L_1/L_2 = 5$	sπ ce$^-$	
	0.1294	$L_1/L_2 = 3$	d~4^{h}Au	

L.P.Gillon, K.Gopalakrishnan, A.de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Pt^{193}	τ_1		3.4^d		Pt^{192}(pile n)
78 115	γ	IT	0.1355	$K/L_1 = 0.25$	sπ ce$^-$
3.4^d				$L_3/L_1 = 1.5$	
			~1.6 ?		scin

J.M.Cork, M.K.Brice, L.C.Schmid, G.D.Hickman, H.Nine, Phys. Rev. 94, 1218 (1954).

Pt^{195}	τ_1		~6^d		Pt^{194}(pile n)
78 117	γ		0.0311	$L_1:M = 32:5$	sπ ce$^-$
~6^d			0.0991		
				$K:L_1:L_3:M = 23:13:1:5$	
		IT	0.1299*		
				$K:L_1:L_3 = 10:50:85$	

(0.031 γ) (0.099γ, x ray) (x ray) (x ray)

*Not crossover γ since not found in Au^{195} decay

J.M.Cork, M.K.Brice, L.C.Schmid, G.D.Hickman, H.Nine, Phys. Rev. 94, 1218 (1954).

Pt$^{196?}$		Pt(α,$\alpha'\gamma$)	$E_\alpha = 3.0$	
78 117	γ	0.029		scin
stable		0.098		
		0.128		

H.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

Pt^{199}	β^-	~1.2	Pt(pile n) a$\beta\gamma$	
78 121	γ	0.07	0.54	scin
29^m		0.197	0.71	sπ ce$^-$
		0.246	0.78	
		0.316	0.96	
		~0.48		

(1.2 β) (0.197 γ, 0.246 γ, 0.316 γ, 0.54 γ)

J.M.LeBlanc, J.M.Cork, S.B.Burson, Phys. Rev. 95, 627A (1954).

Au^{191}	τ	~4^h		d 57^{m}Hg
79 112	γ	0.0480		sπ ce$^-$
~4^h		0.0910	$L_2/L_3 = 1.2$	
		0.130		
		0.1587		

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Au$^{191-3}$	τ	2.0^s	Hg(p); Tl(p)
79	No γ		scin
2^s			

Mass assignment from thresholds (values not stated)

A.Henrikson, S.W.Breckon, J.S.Foster, Proc. Roy. Soc. Canada 47, 127A (1953).

Au^{192}	τ	4.8^h	Au^{197}(p); Hg(p)		chem
79 113	γ	0.137	0.402		s
4.8^h		0.158	0.415	ce$^-$	(Pt)
		0.168	0.437		
		0.188	0.467		
		0.205	0.588		
		0.282	0.612		
		0.296	0.765		
		0.316	1.135		

G.T.Ewan, A.L.Thompson, Proc. Roy. Soc. Canada 47, 126A (1953).

γ	20†	0.2958	d 5.7^{h}Hg	sπ ce$^-$
	40†	0.3168		

†Relative intensity of ce$^-$.

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Au^{193}	τ_1		<1^h		d 12^{h}Hg
79 114	γ		0.0319	$L_2/L_3 = 0.65$ E3	sπ
<1^h			0.2181*	$K:L_2:L_3 = 18:8:8$	
		100†	0.2579	$K/L = 5.4$ M4	
		<3†	0.2906		

*Not placed in decay scheme. See Hg^{193}

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93,124(1954); 89, 908A(1953).

Au^{193}	τ_2	17.4^h	Au^{197}(p); Hg(p)		chem
79 114	γ	0.0997	0.2551		s
17.4^h		0.1123	0.2679	ce$^-$	(Pt)
		0.1555	0.3164		
		0.1733	0.4396		
		0.1859			

G.T.Ewan, A.L.Thompson, Proc. Roy. Soc. Canada 47, 126A (1953).

γ	0.1124	sπ ce$^-$
	0.1735	d 12^{h}Hg, d 4^{h}Hg
	0.1862	

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Au^{195}	γ	0.0565	$L_2/L_3 = 1$ E3	sπ ce$^-$
79 116			$M_2/M_3 = 1$	
30^s			$L/M = 1.6$	
		0.2616	$K/L_1 = 5.5$ M1	
			d 40^{h}Hg, not d 9.5^{h}Hg	

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954); 89, 908A(1953).

Au^{195} γ 0.0569 $\alpha \sim \infty$ E3
79 116 L_2/L_3 = 1.05
30^s 0.2615 α_K = 0.25 M1 + E2
K : L : M = 100 : 18 : 5.3
0.318
d 40^hHg, not d 9.5^hHg

O.Huber, J.Halter, R.Joly, D.Maeder, J. Brunner, Helv. Phys. Acta 26, 591A (1953).

Au^{195} γ 0.0308 $L_1/M = 3$ M1 sw ce^-
79 116 0.0988 $K/L \geq 4$ M1
185^d $L_1 : L_2 : L_3 = 70 : 10 : 3$
d 9.5^hHg

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

γ 0.099 scin
0.145
d 40^hHg chem

C.H.Braden, L.O.Wyly, E.T.Patronis, Jr., Phys. Rev. 95, 758 (1954).

Au^{197} γ 0.130 d 23^hHg; Au(n,n') scin
79 118 0.277 K : L : M = 100 : 19 : 4.7
7.4^s α_K = 0.29 M1 + E2
0.407 K/LM = 2.3
$\alpha \sim \infty$ M4 crossover

O.Huber, J.Halter, R.Joly, D.Maeder, J. Brunner, Helv. phys. Acta 26, 591A (1953).

Au^{197} μ 0.14 S
79 118 Q +0.56
stable

W. v. Siemens, Ann. Physik 13, 158 (1953).

No α activity $\tau > 3 \times 10^{16y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf.9a,701 (1954).

$Au^{197}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
γ 0.077 scin
0.190
0.277

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 906 (1954).

$Au^{197}(p,p'\gamma)$ $E_p = 3.0$ to 4.0^*
γ 0.191 scin
0.279 $I = 5/2^*$ $p,\gamma(\theta)$
$E2/M1 \sim 0.6^*$
0.555 $I = 7/2$ $p,\gamma(\theta)$

J.Eisinger, C.F.Cook, C.M.Class, Phys. Rev. 94, 744, 747A; 95, 628A (1954); *verbal report.

Au^{197} $Au^{197}(p,p'\gamma)$ $E_p = 2$ to 4
79 118 γ 0.195 scin
stable 0.277 $I = 5/2$ $p,\gamma(\theta)$
$E2/M1 \sim 0.07$
0.545 $I = 7/2$ $p,\gamma(\theta)$
No 0.268 γ
No $(0.545\,\gamma)(0.195\,\gamma,\ 0.277\,\gamma)$

W.I.Goldburg, R.M.Williamson, Phys. Rev. 94, 747A (1954); 95, 629A, 767 (1954).

$Au^{197}(n,n')7.4^s$Au $E_n = 0.4$ to 5
Threshold 0.42
Levels* 1.2 scin
2
*Slight increases in slope of σ curve

H.C.Martin, B.C.Diven, R.F.Taschek, Phys.Rev. 93,199 (1954); 92,1096A (1953).

$Au^{197}(n,n')7.4^s$Au $E_n = 0.53$ to 2.0
Threshold 0.53
Levels* 1.14 scin
1.44
*Sharp increases in slope of σ curve

A.A.Ebel, C.Goodman, Phys. Rev. 93, 197 (1954).

Au^{198} τ 2.699^d 3 Au^{197}(th n) ic
79 119 No Au^{199} present < 0.26%
2.70^d Counted for 10 half-lives β electroscope

R.E.Bell, L.Yaffe, Can. J. Phys. 32, 416 (1954).

β^- 0.025% 1.371 $\Delta I = 3$, yes sl
γ 0.82% 0.6765 α_K = 0.022 M1 32%
K/L = 5.7
0.16% 1.0889 α_K = 0.0045 E2 100%
K/L = 6.3

L.G.Elliott, M.A.Preston, J.L.Wolfson, Can. J. Phys. 32, 153 (1954).

γ 100 † (0.41) scin
1.3 † (0.68)
0.25† (1.09)

D.Maeder, R.Müller, V.Wintersteiger, Helv. Phys. Acta 27, 3 (1954).

γ (0.68) E2 60% M1 40% $\gamma\gamma(\theta)$
$(0.68\gamma)(0.41\gamma)(\theta)$ I = 2, 2, 0

C.D.Schrader, Phys. Rev. 92, 928 (1953).

Capture γ $Au^{197}(n,\gamma)$ scin
0.248
γ energy range observed 0.1 to 2.0

M.Reier, M.H.Shamos, Phys. Rev. 95, 636A (1954).

Au^{198} $_{79}$ $_{119}$ 2.70^{d}

Capture γ's $Au^{197}(n,\gamma)$ s pr

3 †	4.50	1.6†	6.15
1.7†	5.20	6 †	6.249
1.3†	5.52	2.8†	6.310
1.6†	5.70	2.1†	6.45
1.8†	5.97	1.5†	6.495*

Also graph $E_\gamma = 3.5$ to 7.8

B_n?(Au^{197}) = 6.4 from $Au^{197}(d,p)$

*Probably not Au^{198} g.s. γ which would be M2

†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025 (1953).

Resonance $Au^{197}(n)$ cryst s

4.91ev $\sigma_0 = 31{,}000^*$ $\Gamma = 0.18^*$

$\sigma_0\Gamma^2 = 732^{**}$

*From peak of resonance

**From wings of resonance

H.H.Landon, V.L.Sailor, Phys. Rev. 93, 1030 (1954).

Resonance $Au^{197}(n)$ chopper

(4.94 ev) $\Gamma_\gamma = 0.14$ ev*

J.S.Levin, D.J.Hughes, Phys. Rev. 95, 645A, (1954); *verbal report.

Resonance $Au^{197}(n,n)$

(4.94 ev) J = 2 from σ_s and σ_t

R.E.Wood, Phys. Rev. 95, 644A (1954).

Resonances $Au^{197}(n)$ $E_n = 3$ to 200 ev

E_0 (ev)	σ_0	Γ	
4.94	31,000	0.16	chopper
	$\sigma_0\Gamma^2$		
62	500		
80	30		
110	12		
153	~70		
168	170		
194	~60		

F.G.P.Seidl, D.J.Hughes, H.Palevsky, J.S.Levin, W.Y.Kato, N.G.Sjöstrand, Phys. Rev. 95, 476 (1954).

Hg $Hg(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$

γ 0.163 scin

H.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

$Hg^{<191}$ $_{80}$ $_{<111}$ 25^{m}

τ ~25^{m} Au^{197}(> 65-Mev p) chem

0.0286 $L_1/M_1 \sim 2$ ce^-(Au)

$L_1:L_2:L_3 = 3:1:1$

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

$Hg^{\leq 191}$ $_{80}$ $_{\leq 111}$ 90^{m}

τ 90^{m} Au^{197}(65-Mev p) chem

Weak ce^- sπ ce^-

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

$Hg^{\leq 191}$ $_{80}$ $_{\leq 111}$ ~3^{h}

τ ~3^{h} Au^{197}(65-Mev p) chem

ce^- 0.06802 sπ ce^-

ce^- shows no growth

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Hg^{191} $_{80}$ $_{111}$ 57^{m}

τ 57^{m} Au^{197}(60-Mev p) chem

γ 0.2526 sπ ce^-

0.2741

e^- 0.0111 e_A or ce^-_M 0.0139γ

L.P.Gillon , K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Hg?

Unassigned ce^- Au^{197}(p)chem; sπ ce^-

A = 190, 191	0.0488	0.0634	0.0846	
	0.0617	0.0738		
A = 191	0.0186	0.0690	0.1994	0.2511
	0.0270	0.1161	0.2054	
A = 192	0.0332	0.0440	0.0910	0.1819
	0.0393	0.0850	0.1238	
	0.0436	0.0904	0.1648	

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Hg^{192} $_{80}$ $_{112}$ 5.7^{h}

γ 0.0313 M1(E1?) sπ ce^-

$L_1:L_2:L_3 = 47:10:10$

0.1143 $K/L_1 = 5$ M1

0.1423 $K/L_1 = 3$

0.1460 $K/L_1 = 5$ M1

0.1574 $K/L_1 = 3.5$

0.275 Au(45-Mev p) chem

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Hg^{193} $_{80}$ $_{113}$ 12^{h}

γ 0.0392 $L_1 ce^-$ only M1 sπce$^-$

0.1012 $L_1/L_3 = 0.27$ M4

0.342* $K/L_1 = 8$

D < 1^{h}Au 84% D 4^{h}Hg 16%

*Not placed in decay scheme

27^{h} activity not found for Hg^{193}

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Hg^{193} $_{80}$ $_{113}$ 4^{h}

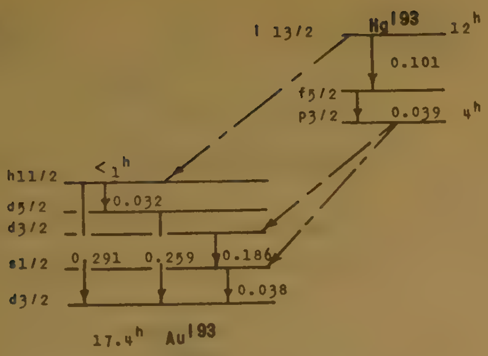
γ 0.0379 $L/M = 5.3$ M1 + E2 sπce$^-$

$L_1:L_2:L_3 = 30:85:40$

0.1865 Au(35-Mev p) chem

(CONTINUED)

Hg^{193}
80 113



L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Hg^{194}
80 114
0.4^s

τ_1 0.40^s Au^{197}(p); Hg(p)
γ 0.048 scin
0.134 M3 or E3 from τ
Mass assignment from thresholds (values not stated)

A.Henrikson, S.W.Breckon, J.S.Foster, Proc. Roy. Soc. Canada 47, 127A (1953).

Hg^{195}
80 115
40^h

τ_1 40^h
γ 0.0371 $\alpha \sim \infty$ $L_1/L_2 = \sim 10$
$L : M : N = 100 : 33 : 18$
0.1227 $\alpha \sim 200$ $L_2/L_3 = \sim 0.3$
$K : L : M = 100 : 442 : 20$
0.559 $\alpha_K = 0.028$
$K : L : M = 100 : 19 : 4.6$
D 9.5^hHg 50% D 30^sAu 50%

O.Huber, J.Halter, R.Joly, D.Maeder, J.Brunner Helv. Phys. Acta 26, 591A(1953).

τ_1 42^h Au^{197}(20-Mev p) chem
γ s 0.26 D 185^dAu scin
w 0.58
w 0.81
vw 1.17
No 0.511 γ
(K x ray) (0.26 γ, 0.58 γ, 0.81 γ)
No (0.26 γ) (0.58 γ)

C.H.Braden, L.O.Wyly, E.T.Patronis, Jr., Phys. Rev. 95, 627A, 758 (1954).

γ 0.0369 M1 $s\pi$ce$^-$
$L_1 : L_2 : L_3 = 10 : 2 : \sim 0$
0.1226 $K/L = 0.2$ M4
$L_1 : L_2 : L_3 = 10 : 2 : 20$
$L/M = 2$
D 9.5^hHg 48% D 30^sAu 52% Au(25-Mev p) chem

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954); 89, 908A (1953).

Hg^{195}
80 115
40^h

γ 0.037 Au^{197}(35-Mev p)
0.056 $s\pi$ ce$^-$
0.122 ce$^-$(Hg)
0.130?
0.206
0.261
0.318
0.558

D.G.Douglas, A.L.Thompson, Proc. Roy. Soc. Canada 45, 173A (1951).

Hg^{195}
80 115
9.5^h

τ_2 9.5^h not D 30^sAu
γ 0.0614 $L_1L_2/L_3 = 1.8$
0.179
0.600
100† 0.779 $\alpha_K = 0.016$ $K/LM = 4.3$
40† 1.15

O.Huber, J.Halter, R.Joly, D.Maeder, J. Brunner, Helv. Phys. Acta 26, 591A (1953).

γ 0.061 Au^{197}(35-Mev p)
0.180 $s\pi$ ce$^-$
0.600
0.780

D.G.Douglas, A.L.Thompson, Proc. Roy. Soc. Canada 45, 173A (1951).

γ 0.0612 M1 + E2 $s\pi$ce$^-$
$L_1 : L_2 : L_3 = 12 : 11 : 10$
0.1798 $K/L > 4$ M1
ce$^-$(0.0612 γ)/ ce$^-$(0.1798 γ) = 29
No 0.262 γ (< 10%) Au^{197}(25-Mev p) chem

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Hg^{197}
80 117
23^h

τ_1 24^h *I* Au^{197}(12-Mev p) chem
γ 0.133 scin
0.279*
0.58 ?
*0.279 γ follows a $29^h \pm 2$ half-life ?

C.H.Braden, L.O.Wyly, E.T.Patronis, Jr., Phys. Rev. 95, 627A, 758(1954).

Hg^{197}
80 117
65^h

γ 0.0776 $\alpha = 2.5$ d 23^hHg
$L_1L_2/L_3 = 5$
0.192 $\alpha_K = 0.9$ M1
$K : L : M = 100 : 16 : 4.8$

O.Huber, J.Halter, R.Joly, D.Maeder, J.Brunner, Helv. Phys. Acta 26, 591A (1953).

Hg^{198}
80 118
stable

Level Hg(γ,γ') $E_\gamma = 0.411$
(0.411) $\tau = 2.2 \times 10^{-11}$s*
Source rotated to compensate for recoil
*With statistical weight factor of 5

W.G.Davey, P.B.Moon, Proc. Phys. Soc. 66A, 956 (1953).

Hg^{198} 80 118 stable

Level Hg(γ,γ') $E_\gamma = 0.411$

(0.411) $\tau = 3.3\times10^{-11s}$

Source heated to compensate for recoil

F.R.Metzger, W.B.Todd, Phys. Rev. 95,853 (1954).

Hg^{199} 80 119 stable

Level Hg(γ,γ') $E_\gamma = 0.209$

(0.209) $\tau = 3.1\times10^{-10s}$

Source heated to compensate for recoil

F.R.Metzger, W.B.Todd, Phys. Rev. 94, 794A (1954); J. Franklin Inst. 257, 248 (1954).

Level* Hg(n,n')44^{m}Hg

0.620

*Sharp increase in slope of σ curve

C.P.Swann, F.R.Metzger, Phys. Rev. 95, 637A (1954).

Resonance Hg(n) chopper

23 ev $\Gamma_\gamma = 0.15$ ev*

J.S.Levin, D.J.Hughes, Phys. Rev. 95, 645A (1954); *verbal report.

Hg^{200} 80 120 stable

Capture γ's Hg(n,γ) s pr

2†	4.66	3†	5.39
4†	4.73	5†	5.65
3†	4.83	12†	5.959
1†	4.95	5†	6.446
3†	5.07	0.3†	6.6 ?
		0.3†	7.1 ?

Also graph $E_\gamma = 2.5$ to 7.5

†Photons per 100 captures in Hg

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

Hg^{201} 80 121 ?

τ_1 < 1^m or > 10^m Hg^{204}($\leq$20-Mev γ)

No γ activity (< 1% of expected M4 IT)

I.Bergström, R.D.Hill, G. de Pasquali, Phys. Rev. 92, 918 (1953).

Hg^{201} 80 121 stable

Q 0.6 HgCl$_2$ quad res

H.G.Dehmelt, H.G.Robinson, W.Gordy, Phys. Rev. 93, 480 (1954); 93, 920A (1954).

Hg^{203} 80 123 ?

τ_1 < 1^m or > 10^m Hg^{204}($\leq$20-Mev γ)

No γ activity (< 1% of expected M4 IT)

I.Bergström, R.D.Hill, G. de Pasquali, Phys. Rev. 92, 918 (1953).

Hg^{203} 80 123 47^d

β^- 0.210 Hg(pile n) ms; sl

γ 0.279 $\alpha_K = 0.15$ E2,M1 slce$^-$

K/LM = 2.8

S.Thulin, K.Nybö, Arkiv Fysik 7, 289 (1954).

Hg^{203} 80 123 47^d

β^- 0.22 Hg(pile n); sl

γ 0.279 $\alpha_K = 0.14$ sl ce$^-$

K/LM = 2.57

No 0.498 β (< 1.5%)

A.H.Wapstra, D.Maeder, G.J.Nijgh, L.Th.M.Ornstein, Physica 20, 169 (1954).

Tl

No α activity $\tau > 6\times10^{15y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf. 9a,701 (1954).

Tl$(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$

γ 0.220? scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Capture γ's Tl(n,γ) s pr

7†	4.72	4†	5.90
4†	4.91	8†	6.20
7†	5.25	4†	6.54
17†	5.63		

Also graph $E_\gamma = 2.5$ to 8

B_n(Tl$^{203?}$) = 6.5; B_n(Tl$^{205?}$) = 6.2 from Tl(d,p)

†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025 (1953).

Tl^{197} 81 116 0.54^s

τ_1 0.54^s Hg(p); Tl(p)

γ 0.384 $\alpha = 2.7$ scin

Mass assignment from thresholds (values not stated)

A.Henrikson, S.W.Breckon, J.S.Foster, Proc. Roy. Soc. Canada 47, 127A (1953).

Tl^{198} 81 117 1.8^h

τ_1 1.75^h Au^{197}(40-Mev α); ms

M.C.Michel, D.H.Templeton, Phys. Rev. 93, 1422 (1954).

τ_1 1.9^h Hg(11-Mev d) chem

γ 0.0487 $s\pi$ ce$^-$

0.2607 K/L = 0.6 M4

$L_1/L_3 = 1.33$

0.2824 M1 + E2

$(ce^-_K\ 0.261\gamma)/(ce^-_K\ 0.282\gamma) = 1.45$

I.Bergström, R.D.Hill, G. de Pasquali, Phys. Rev. 92, 918, 849A (1953).

Au^{197}(36-Mev α) chem

γ 95* 0.0484 $\alpha > 10$ E2 $s\pi/2$ ce$^-$

$L_1:L_2:L_3:MN = <1.5:3.7:34:24$

100* (0.2607) M4

$K:L_1:L_3:MN = 44:26:18:12$

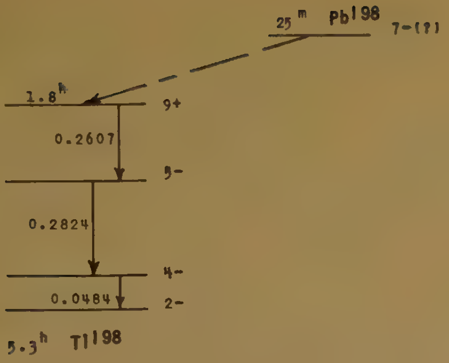
21* (0.2824) $K/L_1 = 9$

(K x ray)(0.282 γ)

*Relative intensity of ce$^-$

(CONTINUED)

Tl^{198}
81 117
1.8^h



T.O.Passell, M.C.Michel, I.Bergström, Phys. Rev. 95, 999 (1954).

Tl^{198} 81 117 5.3^h

τ_2 5.3^h Au^{197}(40-Mev α); ms

M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

τ_2 5^h Hg(11-Mev d) chem

γ 0.195
0.284
0.402
0.411
0.675

$(0.411\gamma)/(0.675\gamma)\sim10$

I.Bergström, R.D.Hill, G. de Pasquali, Phys. Rev. 92, 918, 849A (1953).

Tl^{199} 81 118 7.4^h

τ 7.4^h Au^{197}(40-Mev α); ms

M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

γ 0.0500 Hg(11-Mev d) chem
$s\pi$ ce$^-$
0.1584
0.2081
0.2472 $L_1/L_2\sim10$ M1
0.3336
0.4546 No L_2 ce$^-$ M1
0.4913 No L_2 ce$^-$ M1

Not p 44^m Hg(0.367γ not observed)

I.Bergström, R.D.Hill, G. de Pasquali, Phys. Rev. 92, 918 (1953).

Tl^{200} 81 119 27^h

τ 27^h Au^{197}(40-Mev α); ms

M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

γ 0.116* Hg(11-Mev d) chem
$s\pi$ ce$^-$
0.252
0.289
0.3678 K/L = 2.0 L_1L_2/L_3 = 3.0
0.579
0.629
0.660*
0.786*
0.829

*Assignment doubtful

I.Bergström, R.D.Hill, G. de Pasquali, Phys. Rev. 92, 918 (1953).

Tl^{201} 81 120 3^d

γ 0.0305* M1 ? $s\pi$ ce$^-$
0.0321* M1 ?
0.1353 $L_1/L_2\sim10$ M1
0.1676 $L_1/L_2\sim10$ M1

No 0.21γ No 0.55γ
*Only L_1 ce$^-$ observed Hg(11-Mev d) chem

I.Bergström, R.D.Hill, G. de Pasquali, Phys. Rev. 92, 918 (1953).

Tl^{202} 81 121 12^d

γ 0.4391 K/L = 2.6 $s\pi$ ce$^-$
L_1L_2/L_3 = 3.5 E2

No other γ Hg(11-Mev d) chem

I.Bergström, R.D.Hill, G. de Pasquali, Phys. Rev. 92, 918 (1953).

Tl^{203} 81 122 stable

Level Tl(γ,γ') E_γ = 0.280
(0.280) $\tau\sim1\times10^{-9s}$
Source heated to compensate for recoil

F.R.Metzger, W.B.Todd, Phys. Rev. 95,627A (1954).

Tl^{204} 81 123 4.1^y

τ 4.1^y *1*
Counted over a period of 3.4 years

D.L.Horrocks, A.F.Voigt, Phys. Rev. 95, 1205 (1954).

Tl(pile n)
β^- 0.77 $\Delta I = 2$ yes, shape sl
$\epsilon_K/\beta^-\sim0.05$ from e_A/β^- = 0.003

T.Yuasa, J.Laberrigue-Frolow, L.Feuvrais, Compt. rend. 238, 1500 (1954).

β^- 0.766 *2* Tl(pile n); s
Spectrum deviates from $\Delta I = 2$, yes shape below 0.4-Mev (excess of β's$\sim$5%)

J.C.Knight, T.H.Braid, H.O.W.Richardson, Proc. Phys. Soc. 67A, 881 (1954).

Tl^{206} 81 125 4.19^m

No long-lived activity found for Tl^{206} ms

M.C.Michel, D.H.Templeton, Phys. Rev. 93,1422 (1954).

Resonance Tl(pile n)4.19^{m}Tl
$\sim$10 kev B absorption

H.W.Newson, R.H.Rohrer, Phys. Rev. 94, 654 (1954).

Tl^{208} 81 127 3.1^m

β^- 1.25* s
1.6 *
1.8 *

γ $\sim$6†* (0.277) scin, s ce$^-$
32† (0.511) E2 63% M1 37%
$(0.511\gamma)(2.62\gamma)(\theta)$ I(3.71 level) = 5
88† (0.583) α_K = 0.015 E2
$\tau = 2.4\times10^{-10s}$
$(0.583\gamma)(2.62\gamma)(\theta)$ I = 5, 3, 0
11† (0.860) M1$^-$ > 99.9%
$(0.860\gamma)(2.62\gamma)(\theta)$ I = 4, 3, 0

$\sim$0.6† (1.094)
100† (2.615) α_K = 0.0018 E3

L.G.Elliott, R.L.Graham, J.Walker, J.L.Wolfson, Phys. Rev. 93,356 (1954); 94,795A (1954); * verbal report.

Tl^{208} 81 127 3.1^m

γ 0.5108 3 d 10.6^{h}Pb; sl ce$^-$
2.614 2

$H\rho$ (L) = 2606.9 ± 1.0
$H\rho$ (x) = 9985 ± 5.0

D.I.Meyer, F.M.Schmidt, Phys. Rev. 94, 927 (1954).

$\Gamma(e^-_K$ 0.277 $\gamma)$ ~60 ev sm
This is expected width of K electron level

H.Slätis, Arkiv Fysik 6, 415 (1953).

$Tl^?$

Unassigned ce$^-$ Hg(11-Mev d) chem

τ = 5^h to 27^h	0.0369	0.0376	0.1326	sm ce$^-$
τ = 6$^{h?}$	0.458 0.465	0.473 0.480	0.503 0.508	0.513
τ = 27$^{h?}$	0.0814 0.0829 0.0838	0.0997 0.1371 0.2260	0.2717 0.2935 0.2996	0.3038
τ = ?	0.1651 0.1887 0.1959 0.2015	0.3326 0.3336 0.3924 0.414	0.582 0.604 0.618 0.640	0.667 0.687

I.Bergström, R.D.Hill, G. de Pasquali, Phys. Rev. 92, 918 (1953).

Pb

No α activity $\tau > 2\times10^{17y}$ for $1.5 < E_\alpha < 2.5$

W.Porschen, W.Riezler, Z.Naturf. 9a,701(1954).

Pb(n,n'γ) E_n = 3.9

γ 0.85 scin
2.60

M.A.Rothman, C.E.Mandeville, Phys. Rev. 93, 796 (1954); 92, 1097A (1953).

Pb(p,p'γ) E_p = 3

No γ scin

C.M.Class, C.F.Cook, J.T.Eisinger, Phys. Rev. 94, 809A (1954).

Pb

Pb(α,α'γ) E_α = 3.0

No γ with $E_\gamma < 0.5$ scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954).

Pb^{201} 82 119 8.4^h

τ 8.4^h Tl(28-Mev d) chem

γ 100† 0.325 K/LM = 5 sl ce$^-$
33† 0.583

A.H.Wapstra, D.Maeder, G.J.Nijgh, L.Th.M.Ornstein, Physica 20, 169 (1954).

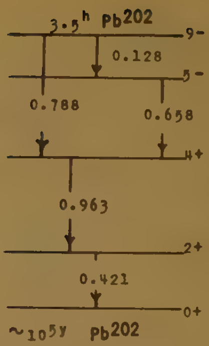
Pb^{202} 82 120 3.5^h

τ_1 3.5^h Tl(16-Mev d) chem

			K/LM	α_K	sl ce$^-$
γ		0.128	< 0.03		E4
		0.392			
	95†	0.421	1.9	0.035	E2
	< 15†	0.461	1.6	> 0.08	M1
	36†	0.658	8	0.0050	E1
	54†	0.788	1.08	0.09	E5
	106†	0.963	4.5	0.0055	E2
x	13†	K x ray			

D.Maeder, A.H.Wapstra, G.J.Nijgh, L.Th.M. Ornstein, Physica 20, 521(1954); Phys. Rev. 93, 1433 (1954).

Pb^{202} 82 120 3.5^h



D.Maeder, A.H.Wapstra, G.J.Nijgh, L.Th.M. Ornstein, Physica 20, 521 (1954); Phys. Rev. 93, 1433 (1954).

Pb^{203} 82 121 52^h

Tl(14-Mev d) chem

γ 120† 0.280 K/LM = 2.5 scin
5† 0.403 α_K = 0.076 K/LM = 3.7
E2 75%* $\gamma\gamma(\theta)$
1† 0.683

No 0.153 γ (< 3†)
(0.403 γ)(0.280 γ)(θ) I = 5/2, 3/2, 1/2
(x ray)(0.683 γ)
No ϵ to g.s. (< 2%) xx/x ÷ xγ/0.28 γ
*Based on 75% E2 for 0.280 γ

J.Varma, Phys. Rev. 94, 1688, 795A (1954); J. Franklin Inst. 257, 247 (1954).

Tl(28-Mev d)chem; sl ce$^-$

γ 82.3† 0.279 K/LM = 2.55 L/MN = 3.5
3.8† 0.400 α_K = 0.12
K/LM = 4.9 L/MN = 4.5
0.7† 0.678 α_K = 0.009

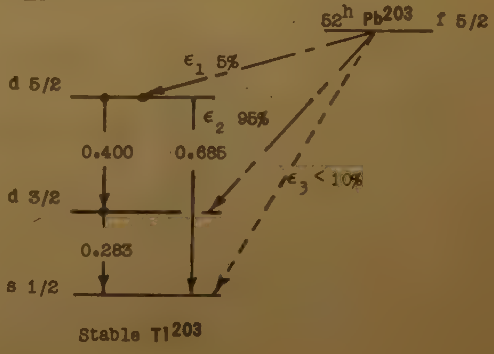
(0.400γ)(0.279γ) scin
E_{dis} = 1.8 ± 0.5 from ϵ_K/ϵ = 0.74 ± 0.05
based on 0.279γ/x_K in Hg^{203} and Pb^{203}

A.H.Wapstra, D.Maeder, G.J.Nijgh, L.Th.M.Ornstein, Physica 20, 169 (1954).

Tl(20-Mev d)chem;d 12^{h}Bi chem

γ_1 100† 0.280 scin
γ_2 4.7† 0.400 $\tau \leq 10^{-7s}$
γ_3 0.87† 0.685

$\gamma_1\gamma_2$ $x_K\gamma_1$ $x_K\gamma_2$
$\gamma_1\gamma_2(\theta)$ consistent with I = 5/2, 3/2, 1/2
$\epsilon_1(K)/\epsilon_1(L)$ = 3 $\epsilon_2(K)/\epsilon_2(L)$ = 7
consistent with E_{dis} = 1.4
No ϵ_3 (< 10%)



J.R.Prescott, Proc. Phys. Soc. 67A,254(1954).

Pb^{204} γ_2 0.374 scin
82 122 γ_3 0.890
68^m γ_1 0.905
$(0.905\ \gamma)(0.374\ \gamma)$ delay $= 2.6 \times 10^{-7s}$
$(0.905\ \gamma)(0.890\ \gamma)$ delay $= 2.6 \times 10^{-7s}$
$E_\gamma = 2.17$ per disintegration 4π scin
g(1.264-Mev level) = 0.06 $\gamma\gamma(\theta,H)$

V.E.Krohn, S.Raboy, Phys. Rev. 95, 1354,608A, (1954).

g(1.264-Mev level*) ~ 0.07 $\gamma\gamma(\theta,H)$
Mass assignment of 68^mPb confirmed
$Tl^{203}(d,n)$

H.Frauenfelder, J.S.Lawson, Jr., W.Jentschke, Phys. Rev. 93, 1126 (1954). *See above.

γ 135† 0.374 K/LM = 1.8 $\alpha_K = 0.04$
100† 0.913 K/LM = 1.3 $\alpha_K = 0.05$
†Relative intensity of ce_K^- sl ce^-
Mass assignment of 68^mPb confirmed ms*

D.Maeder, A.H.Wapstra, G.J.Nijgh, L.Th.M.Ornstein, Physica 20, 52 (1954); *S.Thulin, ibid.

γ (0.905) E4 90% M5 10% $\gamma\gamma(\theta)$
$(0.905\gamma)(0.374\gamma)(\theta)$ I = 6+, 2+, 0+
E4,M5 assignment based on $\alpha_K = 0.06$

H.Frauenfelder, J.S.Lawson, Jr., W.Jentschke, G. DePasquali, Phys. Rev. 92, 1241 (1953).

Pb^{205} τ_{ϵ_K} $> 10^{10y}$ Pb^{204} (pile n)
82 123 No Tl K x rays observed
?

C.D.Coryell, R.H.Herber, T.T.Sugihara, W.E.Bennett, Bull. Research Council Israel 3, 439A (1954); Phys. Rev. 95, 298A (1954).

τ $> 10^{6y}$
No long-lived Pb activity observed from
Tl(20-Mev d) or decay of 14.5^dBi; chem

P.F.D.Shaw, J.R.Prescott, Proc. Phys. Soc. 67A, 283 (1954).

Pb^{206} Level Pb(n,n'γ) $E_n = 1.2$ to 2.7
82 124 γ 0.81 scin
stable Graph of σ given

R.M.Klehn, C.Goodman, Phys. Rev. 95,989(1954).

Pb^{207} τ 0.84^s d $\sim 50^y$Bi chem
82 125
0.82^s E.C.Campbell, ORNL-1620 (1953).

$(ce_K^-\ 1.06\gamma)(0.56\gamma)(\theta)$ d $\sim 50^y$Bi
I = 13/2, 5/2, 1/2 scin

F.K.McGowan, Phys. Rev. 92, 524 (1953).

Pb^{210} β^- 0.023 *3* pc
82 128 F-K plot linear to ~6 kev
22^y

E.Huster, Z. Physik 136, 303 (1953); Naturwiss. 40, 197 (1953); Phys. Rev. 92, 1076(1953).

γ 0.6† 0.031 scin, pc
3.8† (0.047)
x 19† L x ray
No $\gamma\gamma$ No other γ's (< 0.1†)
†Photons per 100 disintegrations

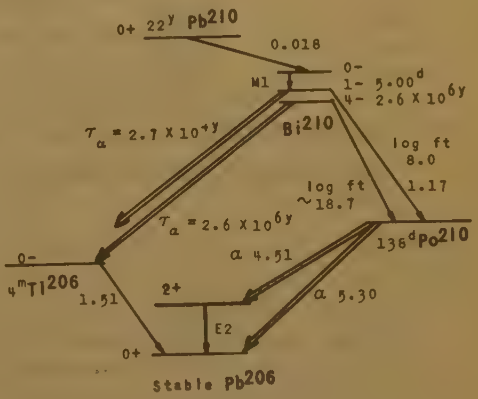
P.E.Damon, R.R.Edwards, Phys. Rev. 95,1698 (1954).

γ (0.047) s
$L_1 : L_2 : L_3 : M : NO$
39 : 6 : 0.35 : 10 : 3.1* M1
ce^- 0.3* 0.0319 origin unknown
No 0.0075 transition
*ce^- per 100 decays

A.A.Bashilov, B.S.Dzhelepov, L.S.Chervenskaya, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 428 (1953); Chem. Abstr. 48-24901 (1954).

Not p 2.6×10^{6y} Bi $< 10^{-4}$%
No long-lived α's in Bi extracted from U ore

H.B.Levy, I.Perlman, Phys. Rev. 94,152 (1954).



Pb^{212} γ 0.23863 *6* sl ce^-
82 130 $H\rho(F) = 1388.56 \pm 0.21$
10.6^h $\Gamma(e_K^-\ 0.238\ \gamma) \sim 50$ ev
H determined (2-20 kev) with e^- accelerated
through known potential

D.I.Meyer, F.H.Schmidt, Phys. Rev. 94, 927 (1954); 89, 908A (1953).

γ (0.239)
τ between (20 and 2) $\times 10^{-14s*}$
From diffraction of x rays following internal
conversion in crystal containing Pb^{212}.

J.W.Knowles, Phys. Rev. 94, 795A(1954); *verbal report.

Pb^{212}
82 130
10.6^{h}

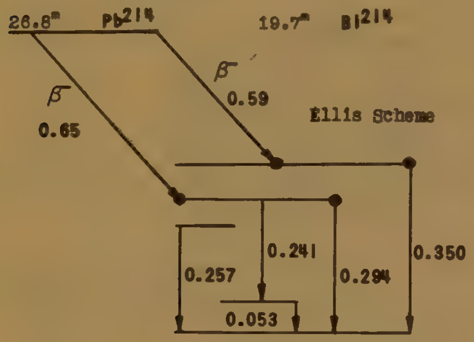
$\Gamma(e^-_K\ 0.239\gamma)$, $\Gamma(e^-_K\ 0.300\gamma) \sim 80$ ev sm
This is expected width of K electron level

H.Slätis, Arkiv Fysik 6, 415 (1953).

Pb^{214}
82 132
26.8^{m}

β^-	56%	0.59	Rn^{222}	sm
	44%	0.65		

$(0.59\beta)(ce^-0.35\gamma)$ $(0.65\beta)(ce^-0.29\gamma)$
No $(ce^-0.35\gamma)(ce^-0.29\gamma,\ ce^-0.24\gamma)$
Supports decay scheme of Ellis



S.Kageyama, J. Phys. Soc. Japan 8, 689 (1953).

		K	L$_1$	L$_2$	L$_3$	sm/2
γ	0.05323		650	124	10	M1
	0.2419	425	78	17	<4	M1
	0.25885	31	5			
	0.2952	510	79	13	<5	M1
	0.3520	550	94	17	<6	M1

Relative intensity of M, N, and O lines given

M.Mladjenović, H.Slätis, Arkiv Fysik 8, 65 (1954).

$\Gamma(e^-_K) - \Gamma(e^-_L) \sim 90$ ev sm/2 ce$^-$
From x ray data expect ~50 ev
Possible reasons for the difference are discussed

M.Mladjenović, Arkiv Fysik 8, 27 (1954).

Bi^{205}
83 122
14.5^{d}

			K/L	sm/2 ce$^-$
γ	100†	0.2844		
	87†	0.704	~5	
	9†	0.912		
	22†	0.989		
	31†	1.045	~4	
	3†	1.074		
	4†	1.190	~4	
	2†	1.615	~4	
	40†	1.766	~5.8	
	4†	1.778		
	2†	1.864	~5	

†Relative intensity ce^-_K

D.E.Alburger, M.H.L.Pryce, Phys. Rev. 95, 1482 (1954).

Bi^{206}
83 123
6.4^{d}

I(ce$^-$)	K/L$_1$L$_2$	E$_\gamma$	I(ce$^-$)	K/L$_1$L$_2$	E$_\gamma$
230		0.1072	21		0.6822
7		0.1236	8	5.4	0.6573
2800	6.0	0.1841	1.1		0.7399
2	0.2	0.2025*	0.7		0.7539
24	5.2	0.2343	85	4.8	0.8033
210	6.0	0.2628	0.3		0.8163
14		0.3136	0.5		0.8417
660	5.4	0.3434	48	4.9	0.8805
13		0.3860	32		0.8951
176	5.7	0.3981	11	6.2	1.0188
137	5.8	0.4971	3	7.1	1.0986
195	1.8	0.5161*	0.2		1.405
208	5.9	0.5375	0.5	8.0	1.5963
27	5.4	0.6206	2.9	6.5	1.7197

			K	L$_{12}$	L$_3$	MN
E3	0.05†	(0.2025)*	2	10	4.4	3.9
E3	38†	(0.5161)*	195	109	~20	43

*Originate from $\tau = 150^{\mu s}$ 2.200-Mev Pb^{206} level
No β^+ (< 0.04%) sl

$(0.538\ \gamma)(0.803\ \gamma)$ (sl ce$^-$)(sl ce$^-$)
$(0.184\ \gamma)(0.263\ \gamma, 0.497\ \gamma, \sim 0.89\ \gamma, 1.019\ \gamma)$
$(0.343\ \gamma)(0.497\ \gamma, 0.516\ \gamma, 0.538\ \gamma, 0.803\ \gamma)$
$(0.398\ \gamma)(0.184\ \gamma, 0.497\ \gamma)$

No $(0.181\ \gamma)(0.343\ \gamma, 0.516\ \gamma, 0.538\ \gamma, 0.803\ \gamma)$
No $(0.343\ \gamma)(0.398\ \gamma, 0.880\ \gamma, 0.895\ \gamma)$
No $(0.538\ \gamma)(0.398\ \gamma, 0.880\ \gamma, 0.895\ \gamma)$
No $(0.398\ \gamma)(0.516\ \gamma)$

(scin γ)(sl ce$^-$)
$(>1.5\ \gamma)(0.343\ \gamma, 0.538\ \gamma, 0.803\ \gamma, \sim 0.89\ \gamma)$
No $(>1.5\ \gamma)(0.184\ \gamma, 0.263\ \gamma, 0.497\ \gamma)$
No $(>1.5\ \gamma)(0.516\ \gamma, 1.019\ \gamma)$

Unassigned ce$^-$

0.0102	0.0260
0.0123	0.0288
0.0143	0.0318
0.0232	

Decay scheme given
All data fit decay scheme deduced from shell model

D.E.Alburger, M.H.L.Pryce, Phys. Rev. 95, 1482 (1954); 92, 514 (1953).

Bi^{207}
83 124
~50^{y}

γ	100 %	0.555	$a_K = 0.015$	$\tau < 10^{-9s}$	E2
	81.5%	1.055	$a_K = 0.096$	$\tau = 0.8^{s}$	M4

$(1.06\gamma)(0.56\gamma)(\theta)$ I = 13/2, 5/2, 1/2 scin
No other γ's

F.K.McGowan, E.C.Campbell, Phys. Rev. 92, 523, (1953)

Pb (27-Mev d) chem

γ	100†	0.565	$a_K = 0.018$ K/LM = 3.0	E2	sl ce$^-$ scin
	74†	1.060	$a_K = 0.113$ K/LM = 3.4	M4	

X ~80† K x ray
e_A : (ce$^-$ 0.56 γ) : (ce$^-$ 1.06 γ) = 14 : 23 : 100
P 0.82^{s}Pb 80 ± 11%

A.H.Wapstra, Arkiv Fysik 7, 279 (1954).

Bi^{207} γ 1.0639 *3* $8\pi\sqrt{2}$
83 124
$\sim 50^{y}$
K/L = 3.95
K/LM = 3.00

D.E.Alburger, Phys. Rev. 92, 1237 (1953).

			xy*	Pb(25-Mev p) chem
γ	157†	0.57	19	scin
	100†	1.07	6	
	≤1.6†	1.46		
	16†	1.76	7	
	0.72†	2.47		

$(0.57\ \gamma)(1.07\ \gamma,\ 1.46\ \gamma,\ 1.76\ \gamma)$
No 0.137 γ, 0.87 γ, 2.05 γ, 2.20 γ, 2.33 γ
No $(0.57\ \gamma)\gamma\gamma$
*Percent of photons coincident with K x ray

J.R.Prescott, Proc. Phys. Soc. 67A,540(1954).

Bi^{209} Levels $Bi^{209}(n,n')$ $E_n = 2.4$ scin
83 126
Stable?

0.23†	g.s
0.06†	0.9
0.03†	1.3

† $d\sigma/d\omega$ at ~ 90°

M.J.Poole, Phil. Mag. 44, 1398 (1953).

Levels $Bi^{209}(n,n'\gamma)$ $E_n = 0.8$ to 2.7
γ 0.90 scin
1.56
Graph of σ from threshold to 2.7

R.M.Kiehn, C.Goodman, Phys. Rev. 95, 989, 636A (1954).

Levels $Bi^{209}(n,n'\gamma)$ $E_n = 2.5$
γ 0.85 scin
1.58

E.A.Eliot, D.Hicks, L.E.Beghian, H.Halban, Phys. Rev. 94, 144 (1954).

$Bi^{209}(n,n'\gamma)$ $E_n = 3.9$
γ 0.91 scin
1.63
2.60
3.35

M.A.Rothman, C.E.Mandeville, Phys. Rev. 93, 796 (1954).

$Bi^{209}(p,p'\gamma)$ $E_p = 3$
No γ scin

C.M.Class, C.F.Cook, J.T.Eisinger, Phys. Rev. 94, 809A (1954).

$Bi^{209}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
No γ with $E_\gamma < 0.5$ scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).

Bi^{210} I 0?
83 127
5.00^{d}
No hfs in λ 3067 indicating g_I small

M.Fred, F.S.Tomkins, R.F.Barnes, Phys. Rev. 92, 1324 (1953).

I 1

K.Smith, quoted by K.G.McNeill, Nucleonics 12, No. 9, 47 (1954).

β^- 1.170 *10* s

A.A.Bashilov, B.S.Dzhelepov, L.S.Chervinskaya, Izvest. Akad. Nauk Ser. Fiz. SSSR 17,428(1953).

e_A	20†	0.075*
	8†	0.080*
	10†	0.086*

*Auger electrons from inner bremsstrahlung
Same lines observed in decay of $60.5^{m}Bi^{212}$

E.T.Novakow, Bull. sci. Cons. Acad. Yugoslavie 1, 11(1953); Phys. Abstr. 57-3817 (1954).

Bi^{210} τ_2 2.6×10^{6y} *8*
83 127
2.6×10^{6y}
From difference between σ_t and $\sigma(5.0^{d}Bi)$

D.J.Hughes, H.Palevsky, Phys. Rev. 92,1206 (1953).

α 4.94 *2* Bi^{209}(slow n) ms
No γ, no e^- scin, ppl
p $138.4^{d}Po$ 0.37 % p $4.19^{m}Tl$ 99.63 %
Not d $22^{y}Pb^{210}$ $< 10^{-4}$ %
No long-lived α's in Bi extracted from U ore

H.B.Levy, I.Perlman, Phys. Rev. 94,152(1954).

Resonances $Bi^{209}(n)$ $E_n = 0.2$ to 13 kev

E_0 (kev)	Γ(ev)	fast chopper
0.810	5.3	s wave
2.37	19	s wave
13*		

L.M.Bollinger, R.R.Palmer, D.A.Dahlberg, Phys. Rev. 95, 645A (1954); *verbal report.

Bi^{211} τ 2.15^{m} Pb^{208}(26-Mev α) chem
83 128
2.16^{m}

F.N.Spiess, Phys. Rev. 94, 1292 (1954).

Bi^{212} α 5.481 s
83 129
60.5^{m}
5.603
5.622
5.765
6.047
6.086

A.Rytz, J.recherches centre nat'l. recherche sci. Labs. Bellevue No. 25, 254 (1953).

Bi^{212}
83 129
60.5^{m}

γ 0.03985* 5 d 10.6^{h}Pb sl ce^{-}
*Assuming L_1 conversion
$H\rho$ (A) = 534.11 ± 0.22

D.I.Meyer, F.H.Schmidt, Phys. Rev. 94, 927 (1954).

Bi^{214}
83 131
19.7^{m}

β^{-}	20%	1.00?	Rn^{222}	s π
	57%	1.65		
	23%	3.2		

S.Kageyama, J. Phys. Soc. Japan 8, 689 (1953).

		K/L		K/L
γ	0.6093	2.5*	1.4159	5.1
	0.7687	3.9	1.5093	
	0.9348	3.2	1.7283	
	1.1204	4.2	1.7644	4.2
	1.1554	5.2	1.8485	
	1.2383	3.3	2.0167	
	1.2813	2.8	2.1170	
	1.3782	3.3	2.2042	7.1

ce^{-} relative intensities given s$\pi\sqrt{2}$
*$K : L_1 : L_2 : L_3 = 30 : 6 : 4 : 2$
57 unassigned ce^{-} from Rn^{222} source

M.Mladjenovic, H.Slätis, Arkiv Fysik 8, 65 (1954).

γ	510†	(0.609)		s$\pi\sqrt{2}$	Cpt line
	110†	(0.769)	56†	(1.509)	
	54†	(0.935)	310†	(1.764)	
	390†	(1.120)	33†	(1.848)	
	140†	(1.238)	100†	(2.204)	
	170†	(1.378)	36†	(2.432)	

Only strongest γ's observed

M.Mladjenović, A.Hedgran, Arkiv Fysik 8, 49 (1954).

γ (1.414) s ce^{-}
$K : L_1 : L_2 : L_3 : M$
$530 : 100 : <20 : <5 : 25$
L ratio limits consistent with theory for
0 to 0 decay

D.E.Alburger, A.Hedgran, Arkiv Fysik 7, 423 (1954).

$\gamma\gamma(\theta)$ found as f(Pb absorber thickness)
Results suggest I = 2, 2, 0 for (1.76 γ) (1.12γ)
I = 2, 2, 0 for (2.09 γ, 1.24 γ) (0.608 γ)

F.Demichelis, R.Malvano, Phys. Rev. 93, 526 (1954); Nuovo Cim. 10, 405, 1359 (1953); Rend. acad. nazl. Lincei 14, 259 (1953).

$Po^{202?}$
84 118
56^{m}

τ 56^{m} Au^{197}(120-Mev N^{14}) chem
α 5.61 ic

W.E.Burcham, Proc. Phys. Soc. 67A, 555 (1954).

Po^{209}
84 125
~200^{y}

γ	~75†	0.270	Bi^{209}(20-Mev p)	scin
	~75†	0.570		
	~75†	0.865		

(0.270 γ) (0.570 γ)
γ's assigned to Po^{209} since no γ known in Po^{208}
†Photons per 10^{4} α's

E.H.Daggett, G.R.Grove, Phys. Rev. 95, 627A (1954).

Po^{210}
84 126
138.4^{d}

τ 138.37^{d} 3
0.5 millicurie sample counted 328 days in low geometry α counter

M.L.Curtis, Phys. Rev. 92, 1489 (1953).

γ 0.804 3 K/LM = 3.8 sl ce^{-}
No other γ observed

D.E.Alburger, M.H.L.Pryce, Phys. Rev. 95, 1482 (1954).

$Po^{210?}$
84 126
138.4^{d}

In addition to g.s. α's (range 20 μ in ppl), 8500 tracks (not electrons) with ranges $\leq 300\mu$ were observed from Po source

M.Ader, J. phys. radium 15, 60 (1954).

Po^{211}
84 127
25^{s}

τ_1		25^{s}	Pb (21-Mev α)	
α	90.5%	7.14		ic
	2.5%	7.85		
	7.0%	8.70		
γ		0.56		scin
		1.06		

(0.56 γ) (1.06 γ)
No (7.14 α)γ indicating α to 0.82*Pb^{207}
Not p 0.52^{s}Po (< 1%)

W.Jentschke, A.C.Juveland, G.H.Kinsey, Phys. Rev. 96, 231 (1954).

τ_1 25^{s} Pb^{208}(18-Mev α) chem
α 7.14 ic
Not d 7.5^{h}At (< 0.01%)

F.N.Spiess, Phys. Rev. 94, 1292 (1954).

Po^{211}
84 127
0.52^{s}

τ_2 0.52^{s} d 7.5^{h}At chem
Pb^{208}(18-Mev α) chem
α (7.43) ic
Long range α ? ~9

F.N.Spiess, Phys. Rev. 94, 1292 (1954).

γ 0.562 scin
0.880
α (0.562 γ)
α (0.880 γ)

J.W.Mihelich, A.W.Schardt, E.Segrè, Phys. Rev. 95, 1508 (1954).

Po^{212}
84 128
$0.30^{\mu s}$

α	10^6†*	8.777
	35†*	9.488
	20†*	10.417
	170†*	10.536

No other α with $E_\alpha \leq 11.29$ (< 1.7†)

A.Rytz, J. recherches centre nat'l. recherche sci. Labs. Bellevue No. 25, 254 (1953). *Compt. rend. 233, 790 (1951).

Po^{212}?
84 128
$0.30^{\mu s}$

In addition to g.s. and long range α's (ranges 48-60 μ in ppl), observed several hundred tracks (not electrons) fanning out from ThB source with ranges $\leq$ 352 μ

M.Ader, J. phys. radium 15, 583 (1954); Compt. rend. 238, 1215 (1954).

At^{205}
85 120
26^m

τ	26^m	Au^{197}(110-Mev C^{13})chem Au^{197}(120-Mev N^{14})chem	
α	5.90		ic

W.E.Burcham, Proc. Phys. Soc. 67A, 555, 733 (1954).

At^{207}
85 122
1.8^h

τ	1.8^h	Au^{197}(120-Mev N^{14})chem Au^{197}(110-Mev C^{13})chem	
α	5.75		ic

W.E.Burcham, Proc. Phys. Soc. 67A, 555, 733 (1954).

At^{209}
85 124
5.5^h

γ	70†	0.0838	$L_2/L_3 = 1.2$	$s\pi$ ce^-
	180†	0.0911	$L_2/L_3 = 1.1$	
	330†	0.195	$K/L_1 = 4$	M1
		0.548	$K/L = 2.8$	sl ce^-
		0.784		

†Relative intensity of all ce^-

J.W.Mihelich, A.W.Schardt, E.Segrè, Phys. Rev. 95, 1508 (1954).

At^{210}
85 125
8.3^h

γ (0.0464) $\tau = 1.52 \times 10^{-9}$ scin
0.046 γ emitted from 1.58 level in Po^{210*}

A.W.Sunyar, Phys. Rev. 95, 626A (1954); *verbal report.

γ		0.0467		E2	$s\pi$ ce^-
			$L_1 : L_2 : L_3 = 0.6 : 17 : 14$		
		0.1165	$K/L \geq 4$	M1	
			$L_1 : L_2 = 9 : 1$		
	80†	0.2460	$K/LM = 0.8$	E2	sl ce^-
			$L_1 : L_2 : L_3 = \sim 10 : 70 : 40$		
	$\leq$ 2†	0.4040	$K/LM = 5$	E1+M2 or	
			$\alpha_K \geq 0.1$	M3	
	100†	1.185	$K/LM = 3.9$	E2	
			$\alpha_K = 0.005$		
	83†	$\left\{ \begin{matrix} 1.441 \\ 1.480 \end{matrix} \right\}$	$\alpha_K = 0.001$ $K/LM = 3.6$	E1	

(CONTINUED)

At^{210}
85 125
8.3^h

γ	19†	1.604	$\alpha_K = 0.001$	E1	
	W	2.23			scin
	VW	2.6			

(0.246 γ)(0.047 γ, 1.60 γ, 2.23 γ, 2.6 γ)
(1.185 γ)(0.047 γ, 0.246 γ, 1.60 γ, 2.6 γ)
(~1.46 γ)(0.047 γ, 0.246 γ, 1.185 γ)
(2.23 γ)(1.185 γ) (K,L x rays)(all γ's)
No (~1.46 γ)(1.60 γ, 2.23 γ, 2.6 γ)
No (1.60 γ)(0.047 γ)
(0.246 γ)(1.185 γ)(θ) I = 4, 2, 0
(1.480 γ)(0.246 γ)(θ) I = 5, 4, 2

Unassigned ce^-		sl ce^-
0.538	0.762	0.885
0.700	0.837	0.923
0.727	0.865	0.939

J.W.Mihelich, A.W.Schardt, E.Segrè, Phys. Rev. 95, 1508 (1954).

At^{211}
85 126
7.5^h

γ	0.22%*	0.671		scin
			Bi^{209}(< 28-Mev α)	chem

(0.671 γ)(α, K x ray) delay > 10^{-7s}
*Intensity constant relative to Po^{211} 0.565 γ

J.W.Mihelich, A.W.Schardt, E.Segrè, Phys. Rev. 95, 1508 (1954).

At^{212}
85 127
0.22^s

τ 0.22^s Bi^{209}(28-Mev α)

M.M.Winn, Proc. Phys. Soc. 67A, 949 (1954).

Rn^{206}?
86 120
6.5^m

τ	6.5^m	Au^{197}(120-Mev N^{14}) chem	
α	6.25		ic

W.E.Burcham, Proc. Phys. Soc. 67A, 555 (1954).

τ 7^m Au^{197}(~80-Mev N^{14})

M.M.Winn, Proc. Phys. Soc. 67A, 949 (1954).

Rn^{207} ?
86 121
11^m

τ	11^m	Au^{197}(120-Mev N^{14}) chem D 1.8^hAt	
α	6.09		ic

$\epsilon/\alpha = 2.6$

W.E.Burcham, Proc. Phys. Soc. 67A, 555 (1954).

Fr^{223}
87 136
21^m

β^-		1.15	d 22^yAc chem;	scin
γ	40†	0.0498		scin
	24†	0.080		
	~3†	0.215		
	~0.8†	0.310		
x		L x rays		pc

No (0.0498 γ)(0.080 γ, 0.215 γ, L x ray)
No (0.215 γ)(0.080 γ)
No other γ (< 0.04†)
†Photons per 100 disintegrations

E.K.Hyde, Phys. Rev. 94, 1221 (1954).

Ra^{224}
88 136
3.64^{d}

α	4.9%	5.445	s
		(5.681)	

F.Asaro, F.Stephens, Jr., I.Perlman, Phys. Rev. 92, 1495 (1953).

γ 0.2411 $\alpha_K = 0.13$ Ra^{224} sm ce$^-$
$\alpha_{L_3} \sim 0.08$ E2

0.24098 γ reported by Muller et al, Phys. Rev. 88, 775 (1952) in source of Th^{228} + decay products, assigned here

S.Rosenblum, M.Valadares, M.Guillot, J. phys. radium 15, 129 (1954); Compt. rend. 234,1767 (1952).

$(5.45\ \alpha)(0.241\ \gamma)(\theta)$ I = 0, 2, 0 scin

J.C.D.Milton, J.S.Fraser, Phys. Rev. 95, 628A (1954).

Ra^{226}
88 138
1620^{y}

γ 290† 0.188 K/LM = 0.45 cc
$\alpha_K = 0.15^*$ E2
38† 0.66
*Assuming 4.61 α in 6.4% of disintegrations

R.R.Roy, M.L.Goes, Compt. rend. 238,469(1954).

$(4.61\ \alpha)(0.19\ \gamma)(\theta)$ I = 0, 2, 0 scin
$A_2 = +0.490$, $A_4 = -1.299$

J.C.D.Milton, J.S.Fraser, Phys. Rev. 95, 628A (1954).

$(4.2\ \alpha)(ce^-\ 0.66\ \gamma)(\theta)$ I = 0, 2, 0 cc
$(4.6\ \alpha)(ce^-\ 0.19\ \gamma)(\theta)$ graph*
$^*A_2 = -0.544$, $A_4 = -0.077$

R.R.Roy, M.L.Goes, Compt. rend 238,581 (1954).

Ra^{228}
88 140
6.7^{y}

~4% L x ray crit a
No 0.03γ (< 1%) crit a

M.Riou, Ann. Phys. 8, 535 (1953).

Ac^{228}
89 139
6.13^{h}

		K	L_1	L_2	L_3	MN*
γ	0.057			24	20	15
	0.078			~0.1		
	0.097		3.3			
	0.127	0.13		3.3	2.3	1.8
	0.184	4.7	1.0			0.3

d Ra^{228} chem sl
ce$^-$/dis = 0.81 Higher energy γ's not studied
$(< 0.060\ ce^-)/(> 0.060\ ce^-) \sim 1$
e_A/dis = 0.32 x_L/dis = 0.29 (estimated)
*ce$^-$ per 100 disintegrations

W.D.Brodie, Proc. Phys. Soc. 67A, 265 (1954).

Ac^{228}
89 139
6.13^{h}

γ	0.098	0.410	scin
	0.127	0.458	
	0.155	0.790	
	0.220	(0.907)	
	0.278	(0.965)	
	0.336	1.587	

$(0.098\ \gamma)(0.410\ \gamma,\ 0.458\ \gamma,\ 0.907\ \gamma + 0.965\ \gamma)$
$(0.127\ \gamma)(0.220\ \gamma)$ $(0.410\ \gamma)(0.965\ \gamma)$
$(0.458\ \gamma)(0.907\ \gamma)$ $(0.790\ \gamma)(0.278\ \gamma, 0.336\gamma)$

H.C.Box, G.S.Klaiber, Phys. Rev. 95, 1247 (1954).

γ (0.057) $\tau > 0.5^s$ β(ce$^-$)

F.Suzor, G.Charpak, J.phys. radium 15, 682 (1954).

Th^{227}
90 137
18.6^{d}

α	~2%	5.651		Ra(n) chem;	s
	15%	5.704	~2%	5.922	
	~1%	5.728	13%	5.952	
	17%	5.749	21%	5.972	
	2%	5.796	5%	6.001	
	4%	5.860	19%	6.030	

M.Frilley, S.Rosenblum, M.Valadares, G.Bouissieres, J. phys. radium 15, 45 (1954).

γ 0.02997 $L_2/L_3 = 0.33$ E2
0.03164 $L_2/L_3 = 0.33$ E2
0.05016 E1
$L_1 : L_2 : L_3 = 7 : 8 : 10$
0.06163 $L_2/L_3 = 0.9$ E2
0.06867
Study of higher energy γ's in progress

M.Frilley, S.Rosenblum, M.Valadares, G.Bouissieres, J. phys. radium 15, 45 (1954).

γ 15† 0.0498 d 22^{y}Ac chem; pc
0.087 scin
~0.14 ?
0.235
$(0.050\ \gamma)(0.087\ \gamma?,\ 0.14\ \gamma?,\ 0.235\ \gamma)$
†Photons per 100 disintegrations

E.K.Hyde, Phys. Rev. 94, 1221 (1954).

Th^{228}
90 138
1.90^{y}

α_2 15% 5.21 ppl
α_1 27% 5.34
α_0 58% (5.42)
α_1 (ce$^-$ 0.084 γ)
α_2 (~0.03 ce$^-$)

C.J.D.Jarvis, Proc. Phys. Soc. 66A, 1074(1953)

α	0.2%	5.173	28 %	5.388		s
	0.4%	5.208	71 %	5.421		
γ	16 †	0.089	$\alpha \sim 16$		E2	scin
	2.6†	0.137	$\alpha \ll 1$		E1	
	0.9†	0.169	$\alpha \sim 1.2$		E2	
	2.7†	0.212	$\alpha \ll 1$		E1	

†Photons per 10^3 α's

F.Asaro, F.Stephens, Jr., I.Perlman, Phys. Rev. 92, 1495 (1953).

Th^{228} 90 138 1.90^y	γ		0.08447 $L_2/L_3 = 1.19$	E2	$s\pi$ ce^-

ce^- now attributed to single γ

S.Rosenblum, M.Valadares, M.Guillot, J. phys. radium 15, 129(1954); Compt. rend. 235, 238 (1952).

γ	100 †	0.0844	Th^{228} source separated from daughters	
	10.5†	0.132		
	6 †	0.167		pc
	18 †	0.214		

No Ra K x ray (< 0.05†)

γ spectra taken at intervals after separation to identify γ's of daughters

J.O.Newton, B.Rose, Phil. Mag. 45, 58 (1954).

Th^{230} 90 140 8.0×10^{4y}	α	0.06%	4.209	~100% Th^{230}	ms
		0.07%	4.293		
		0.08%	4.363		
		0.07%	4.439		
		0.20%	4.474		
		0.07%	4.546		
		23.4%	4.619		
		76.3%	(4.685)		

S.Rosenblum, M.Valadares, J.Blandin-Vial, R.Bernas, Compt. rend. 238, 1496 (1954).

γ	0.06776	$L_2/L_3 = 1.0$	E2	s ce^-
	0.141			
	0.203			
	0.257			

S.Rosenblum, M.Valadares, R.Bernas, Compt. rend. 239, 759 (1954.

γ	(0.068)	$\tau < 10^{-8s}$	90% Th^{230}	
$(\alpha)(0.068\gamma)(\theta)$		I = 0, 2, 0		scin

G.M.Temmer, J.M.Wyckoff, Phys. Rev. 92, 913; 849A(1953).

$(\alpha)(0.068\ \gamma)(\theta)$	I = 0, 2, 0	ic
$(\alpha)(0.142\ \gamma)(\theta)$	I 0, 2, 0	

Attenuation of angular correlation attributed to q of level

P.Benoist, J.Teillac, G.Valladas, P.Falk-Vairant, Compt. rend. 238, 1409, 1656 (1954).

0.0518 e^- (previously unassigned) attributed to L_s e^- of 0.0678 γ (E2)

M.Riou, Ann. Phys. 8, 535 (1953).

Th^{232} 90 142 1.4×10^{10y}	$\bar{E}_\alpha$		3.99 *2*	ppl
	α	(25%)	3.95*	
		(75%)	4.00*	

*From analysis of spectrum into two groups differing by 0.055-Mev

G.Philbert, J.Génin, L.Vigneron, J. phys. radium 15, 16 (1954).

Th^{232} 90 142 1.4×10^{10y}	Level	$Th^{232}(\alpha,\alpha'\gamma)$	$E_\alpha = 3.0$	
	γ	0.050		scin

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

Th^{233} 90 143 23.5^m — Resonances — $Th^{232}(n)$ — E_n = 5 to 140 ev — chopper

E_o (ev)	$\sigma_o\Gamma$
22.1	7
23.8	13
61	10
71	120
117	7
127	20
133	10

F.G.P.Seidl, D.J.Hughes, H.Palevsky, J.S.Levin, W.Y.Kato, N.G.Sjöstrand, Phys. Rev. 95, 476 (1954).

Th^{234} 90 144 24.1^d	β^-	35%	0.100	$s\pi$ $\beta\gamma$
		65%	(0.191)	

$(0.100\beta)(0.090\gamma)$

E.F.deHaan, G.J.Sizoo, P.Kramer, Physica 19, 1201 (1953).

Pa^{230} 91 139 17.7^d	β^-		Th^{232} (26-Mev d)	chem
	β^+	0.2		$s\pi\sqrt{2}$
		0.4		
	γ	0.0486		$s\pi\sqrt{2}$ ce^-
		0.0689		
		0.0995		
		0.462		
	ce^-	0.417		
		0.424		

Ong Ping Hok, G.J.Sizoo, Physica 20, 77 (1954)..

Pa^{231} 91 140 $34{,}300^y$	γ	100†	0.027	scin
		5†	0.048	
		100†	0.295	
	x	~400†	L x ray	
		20†	K x ray	

A.Mouhasser, M.Riou, Compt. rend. 238, 2520 (1954).

Pa^{232} 91 141 1.3^d	τ		1.31^d	Pa^{231} (pile n)	
	β^-	90%	0.304		sl
		8%	0.502		
		2%	1.27		

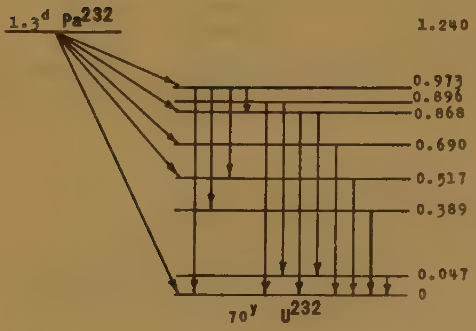
C.I.Browne, D.C.Hoffman, M.L.Smith, M.E. Bunker, J.P.Mize, J.W.Starner, R.L.Moore, J.P. Balagna, Phys. Rev. 96, 827A (1954).

Pa^{232}
91 141
1.3^d

Th^{232} (26-Mev d) chem

β^-	74%	0.26	2%	0.715	sπ√2
	13%	0.37	6%	1.24	
	5%	0.54			

				K/L
γ	0.0472	L_2/L_3 = 1.1	0.690	
	0.1093	L_1/L_3 = 2.5	0.821	4
		K/L	0.844	
	0.389	2	0.868	4
	0.455	4	0.896	> 6
	0.517	8.5	0.973	6
	0.584	~1.5	1.085	
	0.662?	< 1	1.153	



Ong Ping Hok, G.J.Sizoo, Physica 20, 77 (1954).

Pa^{233}
91 142
27.4^d

Th^{232} (26-Mev d) chem

β^-	37%	0.13	8%	0.43	sπ√2
	49%	0.25	6%	0.57	

sπ√2 ce⁻

γ		0.015	w	0.2726
		0.0286	st	0.3013
		0.0385	vst	0.3126
	w	0.0577	st	0.3401
	st	0.0751	w	0.3763
		0.0866	w	0.3987
		0.1022	w	0.4162

Ong Ping Hok, G.J.Sizoo, Physica 20, 77 (1954).

Th^{232} (n,$\gamma\beta$) chem; sl

β^-	~50%	~0.14			
	~45%	0.256			
	~ 5%	0.568			
γ		0.0172	vw	0.272 ?	
	12†	0.0287	5†	0.301	
	5†	0.0407	125†	0.313	
	4†	0.058	10†	0.342	
	22†	0.076		0.400	
	17†	0.087		0.417	
	12†	0.104			

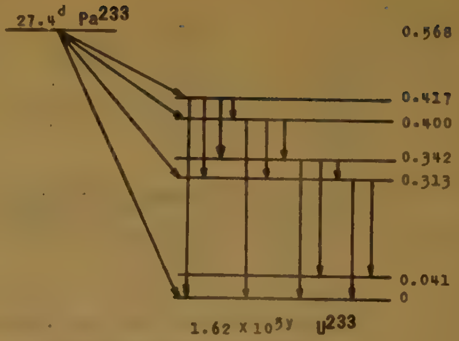
0.474 γ too weak to observe if present

No 0.377 γ

†Relative intensity of ce⁻

(CONTINUED)

Pa^{233}
91 142
27.4^d



W.D.Brodie, Proc. Phys. Soc. 67A, 397 (1954).

Pa^{234}
91 143
1.18^m

d 24.1^dTh sπ

β^{-*}	0.5%**	0.100
	1.4%	0.600
	2.3%	1.500
	96.4%	(2.305)

		sπ γ(ce⁻)
γ^*	0.230	0.578
	0.298	0.728
	0.356	0.802
	0.423	0.875
	0.447	0.926
	0.500	1.036

*From spectrum coincident with > 0.09γ's

**Not measured, estimated from decay scheme

E.F.de Haan, G.J.Sizoo, P.Kramer, Physica 19, 1201 (1953).

scin

γ	0.7†	0.758
	1.0†	0.998
	0.03†	1.49
	0.03†	1.7
	0.1†	1.84

No 0.80 γ (< 0.002†)

No (0.758 γ) (0.998 γ)

No γ with 0.3 < E_γ < 0.7 (< 0.1†)

†Photons per disintegration

W.G.Cross, T.A.Eastwood, Phys. Rev. 95, 628A (1954).

Pa^{234}
91 143
6.7^h

β^-	33%	0.16	sπ√2
	24%	0.33	U chem
	27%	0.55	
	16%	1.15	

UX contamination 0.5 to 8%

γ		0.064**	vw	0.425*	sπ√2
	st	0.099		0.451	ce⁻
	w	0.127		0.506?	
	st	0.153	st	0.567	
		0.200		K/L = 6	
	st	0.225	vw	0.600	
		K/L = 4.5		0.731*	
	w	0.280		0.800	
		0.293		0.877	
	st	0.369		0.924*	

*e_K^- only seen

**From 0.042 e⁻ (assumed e_L^-) and doubtful 0.059 e⁻ (assumed e_M^-). Note 0.044γ in Pu^{238} decay.

Ong Ping Hok, G.J.Sizoo, Physica 19, 1205 (1953).

Pa^{237} τ 10^m U(190-Mev d) chem
91 146 D 6.7^dU chem

W.W.T.Crane, G.M.Iddings, Phys. Rev. 95, 1702 (1954).

U^{232} τ 74^y
92 140
74^y
From specific α activity; ms analysis

P.A.Sellers, C.M.Stevens, M.H.Studier, Phys. Rev. 94, 952 (1954).

U^{233} I 5/2 S
92 141 μ positive
1.62×10^{5y} q large

K.L.Vander Sluis, J.R.McNally, Jr., J. Opt. Soc. Amer. 44, 87 (1954).

U^{234} α ~3% 4.593 enriched U^{234}
92 142 23% 4.707 αe^- ic
2.5×10^{5y} 74% (4.763)

G.Valladas, Compt. rend. 237,1673 (1953).

$(\alpha)(ce^-)$ delay $< 1.4\times10^{-9s}$ scin

D.Engelkemeir, L.B.Magnusson, Phys. Rev. 94, 1395 (1954).

U^{235} I 5/2 S
92 143 μ -0.8
7.1×10^{8y} q ~8

K.L.Vander Sluis, J.R.McNally, Jr., J. Opt. Soc. Amer., 44, 87 (1954).

$N\lambda(U^{235})/N\lambda(U^{234}) = 0.0477 \pm 0.0009$ ic

E.Baldinger, P.Huber, K.P.Meyer, E.Würger, Helv. Phys. Acta 27, 150A (1954).

U^{236} Resonances U(n,f) $E_n = 0.1$ to 2 ev
92 144 0.29 ev crystal s
2.39×10^{7y} 1.13 ev
Slope of $\sigma(U)/\sigma(B)$ suggests resonance at
negative energy

P.Hubert, G.Vendryes, J.M.Auclair, Compt. rend. 238, 1873 (1954).

U^{238} Level $U(\alpha,\alpha'\gamma)$ $E_\alpha = 3.0$
92 146 γ 0.044 scin
4.49×10^{9y} No $0.424\gamma^*$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93,906 (1954); * priv. comm.

U^{239} Resonance U(n) chopper
92 147 6.70 ev $\sigma_0 = 23400^*$
23.5^m $\Gamma = 0.0256$ ev*
$\Gamma_\gamma = 0.024$ ev*

J.S.Levin, D.J.Hughes, Phys. Rev. 95, 645A (1954); *verbal report.

Np^{237} I 5/2 para
93 144 $|\mu|$ ~6
2.2×10^{6y}

B.Bleaney, P.M.Llewellyn, M.H.L.Pryce, G.R.Hall, Phil. Mag. 45, 992 (1954).

$\alpha(< 0.1\ ce^-)$delay $= 3.69\times10^{-8s}$ scin
Delay probably in level at 0.087

D.Engelkemeir, L.B.Magnusson, Phys. Rev. 94, 1395 (1954).

Np^{238} β^- 45% ~0.27 U(12-Mev p)chem; sl
93 145 55% 1.26*
2.1^d
γ 649† 0.0441 $L_2 : L_3 : M = 29 : 21 : 15$
30† 0.1020 $L_2 : L_3 : M = 14 : 9 : 7$
0.5† 0.925?
1.6† 0.939 $K/L_2 = 1.7$
3.9† 0.986 $K/L_2 = 2$
3.6† 1.030 $K : L_2 : M_2 = 22 : 8 : 6$
*Combination of 1.246 and 1.290?
†ce^- per 1000 disintegrations

H.Slätis, J.O.Rasmussen, Jr., H.Atterling, Phys. Rev. 93, 646 (1954).

Pu^{238} α 0.09% 5.352 2 sources with known
94 144 28% 5.452 amounts Pu^{238}
90^y 72% 5.495 s
γ 0.038† 0.0438 pc
0.008† 0.099
0.001† 0.150
x 13† L x ray
†Photons per 100 α's Cf. $6.7^h Pa^{234}$

F.Asaro, I.Perlman, Phys. Rev. 94, 381 (1954).

$(5.452\ \alpha)(0.044\ \gamma)$ I = 0, 2, 0 scin

J.C.D.Milton, J.S.Fraser, Phys. Rev. 95, 628A (1954).

Pu^{239} I 1/2 S
94 145
2.4×10^{4y}

M. van den Berg, P.F.A.Klinkenberg, Physica 20, 37, 461 (1954).

I 1/2 para
$|\mu|$ 0.4
$\mu(Pu^{241})/\mu(Pu^{239}) = 3.53$

B.Bleaney, P.M.Llewellyn, M.H.L.Pryce, G.R.Hall, Phil. Mag. 45, 773, 991 (1954).

τ 2.44×10^{4y} 5 U(n) chem
From specific α activity of four Pu samples
corrected to zero content of Pu^{238} and Pu^{240}

G.W.Farwell, J.E.Roberts, A.C.Wahl, Phys. Rev. 94, 363 (1954).

Pu^{240} 94 146 6580^y	τ	6.3×10^{3y} *6*	U(n)	chem

From specific α activity of four Pu samples with known Pu^{238}, Pu^{239}, and Pu^{240} content

G.W.Farwell, J.E.Roberts, A.C.Wahl, Phys. Rev. 94, 363 (1954).

Pu^{241} 94 147 13^y	I	5/2	para
	$\lvert\mu\rvert$	1.4	

B.Bleaney, P.M.Llewellyn, M.H.L.Pryce, G.R.Hall, Phil. Mag. 45, 991 (1954).

Am^{241} 95 146 470^y	γ	0.02639	E1 cryst,s	ce^-
		0.03312	M1+E2* s	ce^-
		0.04336	M1+E2 s	ce^-
		$L_1 : L_2 : L_3 = 90 : 96 : 100$		
		0.05546	M1+E2 s	ce^-
		$L_1/L_2 \sim 1$		
		0.05962	E1 cryst,s	ce^-
		$L_1/L_3 = 0.8$		
		0.09884	E2* s	ce^-

*From qualative L conversion data

J.Milsted, S.Rosenblum, M.Valadares, Compt. rend. 239, 259, 700 (1954).

Am^{242} 95 147 16.0^h	τ	16.01^h *2*	Am^{241}(pile n)	

Counted 10 samples each for 7 half lives

T.K.Keenan, R.A.Penneman, B.B.McInteer, J. Chem. Phys. 21, 1802 (1953); Phys. Rev. 87, 204A (1952).

Am^{243} 95 148 8800^y	I	5/2	s

$\mu(Am^{241})/\mu(Am^{243}) \sim 1$

J.G.Conway, R.D.McLaughlin, Phys. Rev. 94, 498 (1954).

τ	8.8×10^{3y} *6*		ms

From Am^{243} to Am^{241} α activity ratio in sample with known mass ratio

M.Diamond, P.R.Fields, J.Mech, M.G.Inghram, D.C.Hess, Phys. Rev. 92, 1490 (1953).

α	~3%	5.171	Pu^{239}(pile n)		s
	13%	5.225			
	84%	5.267			
γ		0.075	$\alpha \leq 0.25$	E1	scin

No 5.342 α (<2%)

F.Asaro, I.Perlman, Phys. Rev. 93, 1423 (1954).

Am^{244} 95 149 26^m	τ	26^m	Am^{243}(pile n)	chem
	β^-	1.5		scin

No prominent γ's scin

A.Ghiorso, S.G.Thompson, G.R.Choppin, B.G.Harvey, Phys. Rev. 94, 1081 (1954).

Cm^{242} 96 146 162^d	τ	163^d *2*	microcalorimeter

Counted over 12 month period

W.P.Hutchinson, A.G.White, Nature 173, 1238 (1954).

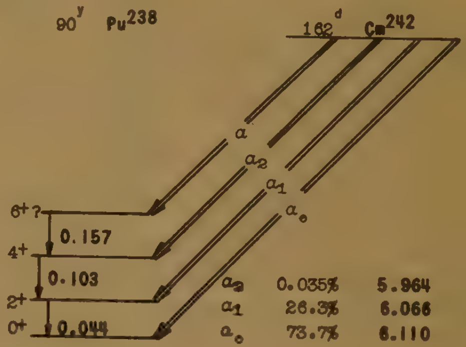
τ	162.5^d *3*	ic

Counted over 7 month period

K.M.Glover, J.Milsted, Nature 173, 1238 (1954).

α	0.035%	5.964	Am^{241}(n,$\gamma\beta$)	chem
	26.3%	6.066		s
	73.7%	6.110		
γ	410†	0.044	$\alpha = 620$	scin
	60†	0.100	$\alpha = 5$	
	27†	0.157		

†Photons per 10^6 α's



F.Asaro, S.G.Thompson, I.Perlman, Phys. Rev. 92, 694 (1953).

Cm^{243} 96 147 ~100^y	α	13%	5.732	Cm^{242}(n,γ)	chem
		81%	5.777		s
		6%	5.985		
	γ		0.226		scin
			0.278		

(5.777α) (0.226γ, 0.278γ)

F.Asaro, S.G.Thompson, I.Perlman, Phys. Rev. 92, 694 (1953).

Cm^{244} 96 148 18^y	τ_α	17.9^y *5*	Pu^{239}(pile n)	chem

By ms determination of Pu^{238} and Pu^{240} from decay of Cm sample of known composition. Used τ_α (Cm^{242}) = 162.5^d

A.M.Friedman, A.L.Harkness, P.R.Fields, M.H.Studier, J.R.Huizenga, Phys. Rev. 95, 1501 (1954).

τ_α	19.2^y *6*	Pu^{239}(pile n)chem	ms

α activity compared to Cm^{242} ($\tau = 162.5^d$)

C.M.Stevens, M.H.Studier, P.R.Fields, J.F.Mech, P.A.Sellers, A.M.Friedman, H.Diamond, J.R.Huizenga, Phys. Rev. 94, 974 (1954).

α	5.755	Pu^{242}(n,$\gamma\beta$)(n,$\gamma\beta$)	chem
	5.798		s

F.Asaro, S.G.Thompson, I.Perlman, Phys. Rev. 92, 694 (1953).

Cm^{245} 96 149 $\sim 1.2\times10^{4y}$	τ		$\sim 2\times10^{4y}$	d 5.0^d Bk chem Cm(pile n) ms*
	α		5.36	ic

Weak higher energy α's not detected

E.K.Hulet, S.G.Thompson, A.Ghiorso, Phys. Rev. 95, 1703 (1954); *F.L.Reynolds, ibid.

	τ_α		1.2×10^{4y} 5	Pu^{239}(pile n) chem

By ms determination of Pu^{240} and Pu^{241} from decay of Cm sample of known composition

Used $\tau_\alpha(Cm^{244}) = 18.4^y$

A.M.Friedman, A.L.Harkness, P.R.Fields, M.H.Studier, J.R.Huizenga, Phys. Rev. 95, 1501 (1954).

Cm^{246} 96 150 $\sim 4000^y$	τ_α		4000^y 600	Pu^{239}(pile n) chem

By ms determination of Pu^{240} and Pu^{242} from decay of Cm sample of known composition

Used $\tau_\alpha(Cm^{244}) = 18.4^y$

A.M.Friedman, A.L.Harkness, P.R.Fields, M.H.Studier, J.R.Huizenga, Phys. Rev. 95, 1501 (1954).

Cm^{247} 96 151 $> 60^d$	τ		$> 60^d$	Pu^{239}(pile n)chem ms

Cm^{244}/Cm^{247} constant over 20 day interval

C.M.Stevens, M.H.Studier, P.R.Fields, J.F.Mech, P.A.Sellers, A.M.Friedman, H.Diamond, J.R.Huizenga, Phys. Rev. 94, 974 (1954).

Bk^{246} 97 149 1.8^d	τ		1.8^d	Am^{243}(27-Mev α) chem
	ϵ		K, L x rays	pc, scin
	γ	$\sim 40\%$	0.82	scin

E.K.Hulet, S.G.Thompson, A.Ghiorso, Phys. Rev. 95, 1702 (1954).

Bk^{249} 97 152 $\sim 1^y$	τ		$\sim 1^y$	Pu^{239}(pile n) chem
	α?	$\sim 10^{-3}\%$	5.4	ic
	β^-		0.10	

τ for spontaneous fission $> 10^{7y}$

H.Diamond, L.B.Magnusson, J.F.Mech, C.M.Stevens, A.M.Friedman, M.H.Studier, P.R.Fields, J.R.Huizenga, Phys. Rev. 94, 1083 (1954).

	τ		$> 7^d$	Pu^{239}(pile n) chem
	β^-			

S.G.Thompson, A.Ghiorso, B.G.Harvey, C.R.Choppin, Phys. Rev. 93, 908 (1954).

Bk^{250} 97 153 3.1^h	τ		3.13^h	Bk^{249}(pile n) chem
	β^-		0.9 1.9	p $\sim 12^y$ Cf scin
	γ		~ 0.9	scin

$(0.9\ \beta)\ (\sim 0.9\gamma)$

A.Ghiorso, S.G.Thompson, G.R.Choppin, B.G.Harvey, Phys. Rev. 94, 1081 (1954).

Cf^{247} 98 149 2.5^h	τ		2.5^h	$Cm^{244}(\alpha)$ chem
	ϵ		K,L x rays	pc, scin

No daughter activity observed

E.K.Hulet, S.G.Thompson, A.Ghiorso, Phys. Rev. 95, 1703 (1954).

	τ		$\sim 2.7^h$	U^{238}($\sim$100-Mev N) chem
	ϵ			

A.Ghiorso, G.B.Rossi, B.G.Harvey, S.G.Thompson Phys. Rev. 93, 257 (1954).

Cf^{248} 98 150 225^d	τ		225^d	U^{238}($\sim$100-Mev N) chem
	α		6.26	

A.Ghiorso, G.B.Rossi, B.G.Harvey, S.G.Thompson Phys. Rev. 93, 257 (1954).

	τ		250^d	Cm(α) p 18^y Cm^{244}
	α		6.26	

τ for spontaneous fission $\sim 7000^y$

E.K.Hulet, S.G.Thompson, A.Ghiorso, Phys. Rev. 95, 1702 (1954).

Cf^{249} 98 151 $\sim 400^y$	τ		$\sim 400^y$	d $\sim 1^y$ Bk chem
	α	90% 10%	5.82 6.0	ic

A.Ghiorso, S.G.Thompson, G.R.Choppin, B.G.Harvey, Phys. Rev. 94, 1081; 93,908(1954).

	τ		$\sim 550^y$	Pu^{239}(pile n)chem ms d $\sim 1^y$ Bk chem
	α		5.81	ic

τ for spontaneous fission $> 10^{6y}$

H.Diamond, L.B.Magnusson, J.F.Mech, C.M.Stevens, A.M.Friedman, M.H.Studier, P.R.Fields, J.R.Huizenga, Phys. Rev. 94, 1083 (1954).

Cf^{250} 98 152 $\sim 9^y$	τ		$\sim 9^y$	Pu^{239}(pile n) chem
	α		6.03	ic

τ for spontaneous fission $> 10^{4y}$

H.Diamond, L.B.Magnusson, J.F.Mech, C.M.Stevens, A.M.Friedman, M.H.Studier, P.R.Fields, J.R.Huizenga, Phys. Rev. 94, 1083 (1954).

	τ		$\sim 12^y$	d 3.1^h Bk chem
	α		6.05	Pu^{239}(pile n)chem; ic

τ for spontaneous fission $\sim 5000^y$

A.Ghiorso, S.G.Thompson, G.R.Choppin, B.G.Harvey, Phys. Rev. 94, 1081 (1954).

Cf^{252}	τ	$\sim 2^{y}$	Pu^{239} (pile n)	chem
98 154 2.1^{y}	τ for spontaneous fission $\sim 100^{y}$			

A.Ghiorso, S.G.Thompson, G.R.Choppin, B.G.Harvey, Phys. Rev. 94, 1081 (1954).

	τ	2.1^{y}	Pu^{239} (pile n)	chem
	α	6.12		lc
	τ for spontaneous fission $\sim 60^{y}$			

M.Diamond, L.B.Magnusson, J.F.Mech, C.M.Stevens, A.M.Friedman, M.H.Studier, P.R.Fields, J.R.Huizenga, Phys. Rev. 94, 1083 (1954).

Cf^{253} 98 155 18^{d}	τ	18^{d}	Pu^{239} (pile n)	chem

M.Diamond, L.B.Magnusson, J.F.Mech, C.M.Stevens, A.M.Friedman, M.H.Studier, P.R.Fields, J.R.Huizenga, Phys. Rev. 94, 1083 (1954).

	τ	$\sim 20^{d}$	Pu^{239} (pile n)	chem
	β^-		D 19^{d}99	chem

G.R.Choppin, S.G.Thompson, A.Ghiorso, B.G.Harvey, Phys. Rev. 94, 1080 (1954).

99^{246}	τ	minutes	U^{238} ($\sim$100-Mev N)	chem
147	ϵ			

Observed only through growth of 1.5^{d}Cf

A.Ghiorso, G.B.Rossi, B.G.Harvey, S.G.Thompson Phys. Rev. 93, 257 (1954).

$99^{247?}$	τ	7.3^{m}	U^{238} ($\sim$100 Mev-N)	chem
148	ϵ?			
7.3^{m}	α	7.35		

A.Ghiorso, G.B.Rossi, B.G.Harvey, S.G.Thompson Phys. Rev. 93, 257 (1954).

99^{253}	τ	19.3^{d}	Pu^{239} (pile n)	chem
154 19^{d}	α	6.61		lc

M.H.Studier, P.R.Fields, M.Diamond, J.F.Mech, A.M.Friedman, P.Sellers, G.Pyle, C.M.Stevens, L.B.Magnusson, J.R.Huizenga, Phys. Rev. 93, 1428; 94, 209 (1954).

	τ	20^{d}	d 18^{d}Cf	chem
	α	6.63		lc

G.R.Choppin, S.G.Thompson, A.Ghiorso, B.G.Harvey, Phys. Rev. 94, 1080 (1954). 93, 908 (1954).

$99^{254?}$	τ	36^{h}	Pu^{239} (pile n)	chem
155 36^{h}	β^-	1.1	D 3.2^{h}100	scin

No spontaneous fission in pure 99 samples

G.R.Choppin, S.G.Thompson, A.Ghiorso, B.G.Harvey, Phys. Rev. 94, 1080 (1954).

	τ	37^{h}	99 (pile n)	chem

P.R.Fields, M.H.Studier, J.F.Mech, M.Diamond, A.M.Friedman, L.B.Magnusson, J.R.Huizenga, Phys. Rev. 94, 209 (1954).

$99^{255?}$	τ	$\sim 30^{d}$	Pu^{239} (pile n)	chem
156			D $\sim 15^{h}$100	

G.R.Choppin, S.G.Thompson, A.Ghiorso, B.G.Harvey, Phys. Rev. 94, 1080 (1954).

$100^{250?}$	τ	$\sim 30^{m}$	U($\sim$180-Mev O^{16})	chem
150	α	7.7		lc

H.Atterling, W.Forsling, L.W.Holm, L.Melander, B.Åström, Phys. Rev. 95, 585 (1954).

$100^{254?}$	τ	3.3^{h}	99 (pile n)	chem
3.2^{h}	α	7.17	d 36^{h}99	lc

P.R.Fields, M.H.Studier, J.F.Mech, M.Diamond, A.M.Friedman, L.B.Magnusson, J.R.Huizenga, Phys. Rev. 93, 1428; 94, 209 (1954).

	τ	3.2^{h}	d 36^{h}99	chem
	α	7.22		lc
	τ for spontaneous fission $\sim 200^{d}$			

G.R.Choppin, S.G.Thompson, A.Ghiorso, B.G.Harvey, Phys. Rev. 94, 1080 (1954); 93, 1129 (1954).

$100^{255?}$	τ	$\sim 15^{h}$	Pu^{239} (pile n)	chem
155 $\sim 15^{h}$	α	7.1	d $\sim 30^{d}$99	lc

G.R.Choppin, S.G.Thompson, A.Ghiorso, B.G.Harvey, Phys. Rev. 94, 1080 (1954).

2. NEUTRON CROSS SECTIONS

Absorption cross sections for neutron energies marked "th" (thermal) have been determined, from measurements in a thermal neutron flux, in terms of the cross section value of a "standard" for neutrons of velocity 2200 m/sec, or energy ~ 0.025 ev. The standard used is stated just after the reference and is generally one known to have a thermal absorption cross section with a 1/v energy dependence. If the nucleus whose cross section is being measured also has a cross section with 1/v dependence, the cross section found for it by comparison with the standard will, of course, be a cross section for 2200 m/sec. If not, and the dependence often is not known, the value found by the comparison is $\overline{\sigma v}$ /2200.

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
H	th	a	0.323 *8*	mean life	54S66
	1.005 *3*	t	4.23 *2*		54F9
	1.315 *3*	t	3.68 *2*		54S84
	2.540 *6*	t	2.525 *9*		54F9
	14.1	el(θ)	graph	cc	54S48
	14.1-18.0	t	table		54C16
	19.93	t	0.50 *1*		53D28
	48	t	0.20 *1*		54H56
	88	t	0.085 *2*		54H56
	~90	el(θ)	graph	n scin	53S72
	~90	el(θ)	graph	n scin	54C43
	95-108	t	table		54C42
	169	t	0.049		53T20
	~300	el(θ)	graph	cc	54D21
	~400	el(θ)	graph	n scin	54H41
	410	t	0.034		54N8
H^2	14.1-18.0	t	table		54C16
	95-108	t	table		54C42
	169	t	0.023		53T20
	410	t	0.062		54N8
He	2.49	t	3.16		53C49
	2.61-14.3	el(θ)	graphs	ic	53S73
	2.99	t	2.79		53C49
	14.1	el(θ)	graph	cc	54S48
	15.7	el(θ)	table	cc	54A28
	18.0	t	0.85		53D28
	19.0	t	0.82		53D28
	20.1	t	0.77		53D28
	48	t	0.38		54H56
	88	t	0.199		54H56
Li	14.1-18.0	t	table		54C16
Li^6	1.1	n,$H^3(\theta)$	table	ppl	54W24
	1.5	n,$H^3(\theta)$	0.32	ppl	54W24
	2.0	n,$H^3(\theta)$	0.27	ppl	54W24
Li^6	14	n,$H^3(\theta)$	0.026	ppl	54F3
	14	n,p(θ)	0.006	ppl	54F3
	14	n,10.4-Mev d	0.077	ppl	54F3
	14	n,~13-Mev d	0.089	ppl	54F3
Li^7	~3	n,H^3	0.070	$12.4^{y}H^3$	54B22
	~4.5	n,H^3	0.030	$12.4^{y}H^3$	54B22
	14	n,p	< 0.005	ppl	54F3
	14	n,$H^3(\theta)$	0.055	ppl	54F3
Be^9	14.1-18.0	t	table		54C16
	410	t	0.231		54N8
B	0.001-0.036 ev	t	graph	chopper	53C35
	{ 0.0253 ev	a	749 *4*		53C35
	Value from 1/v line				
	< 0.2% H_2O by weight in B_2O_3 sample				
	0.0253 ev	a	755 *3*		53K54
	th	a	744 *20*	mean life	54S66
B^{10}	14.1	n,d_o*	0.021	pc	54R15
	14.1	n,d_1*	0.016	pc	54R15
	*d_o to g.s. Be^9; d_1 to 2.43-Mev level Be^9				
	14.1-18.0	t	table		54C16
B^{11}	14	n,α	~0.03	pc	54H59
	14.1-18.0	t	table		54C16
C	1.315	t	2.19 *2*		54S84
	2.20	el	1.65		53R25
	14.1-18.0	t	table		54C16
	17.2-20.1	t	table		53D28
	48	t	0.98		54H56
	62-108	t	table		54C42
	88	t	0.560		54H56
	169	t	0.323		53T20
	410	t	0.297		54N8
C^{12}	14.1	n,n'+4.4γ	0.3	γ scin	54T14
C^{13}	th	n,γ	0.9 ± 0.2mb	~$5600^{y}C$	54H44

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
N	3-13	t	graph		54N17
	14.1	el(θ)	0.82	cc	54S48
	14.1	in el(θ)	0.48	cc	54S48
	14.1	2 prong	0.27	cc	54S48
	14.1	3 prong	0.016	cc	54S48
	48	t	1.11		54H56
	88	t	0.64		54H56
N^{14}	14	n,2n	~0.0034	10.1^{m}N	54D9
O	14.1-18.0	t	table		54C16
	48	t	1.22		54H56
	88	t	0.74		54H56
	95-108	t	table		54C42
	169	t	0.430		53T20
	410	t	0.378		54N8
O^{16}	12-18	n,p	graph	7.4^{s}N	54M2
	14.1	n,n'+6.1γ	0.2	γ scin	54T14
	14.1	n,n'+~7γ	0.05	γ scin	54T14
F^{19}	3-13	t	graph		54N17
	19.0	t	1.84		53D28
Mg	3-13	t	graph		54N17
	14.1-18.0	t	table		54C16
Al^{27}	0.8-2.7	n,n'+0.85γ	graph	γ scin	54K24
	1.0-2.7	n,n'+1.03γ	graph	γ scin	54K24
	2.2-2.7	n,n'+2.23γ	graph	γ scin	54K24
	2.5	el	1.0	n scin	53P17
	2.5	n,1.4n'	0.5	n scin	53P17
	14.1-18.0	t	table		54C16
	19.0	t	1.84		53D28
	48	t	1.75		54H56
	88	t	1.20		54H56
	95-108	t	table		54C42
	410	t	0.587		54N8
Si	19	t	1.94		53D28
	95-108	t	table		54C42
Si^{30}	pile	n,γ	0.094	2.65^{h}Si	54L3
P^{31}	th	s coh	3.7		53P21
	0.13-0.85	t	graph		53H35
	3-13	t	graph		54N17
S	2.2-4	(n,α)/(n,p)	graph		54H37
	14.1-18.0	t	table		54C16
	410	t	0.672		54N8

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
S^{32}	pile	n,p	0.15	14.3^{d}P	53S66
Cl	3-13	t	graph		54N17
	410	t	0.74		54N8
Cl^{35}	th	n,p	0.30	ppl	54B65
Cl^{37}	pile	n,γ	~0.005	1.0^{s}Cl	54S37
A	0.45-1.10	t	graph		53G33
	48	t	2.08		54H56
	88	t	1.48		54H56
Ti	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
Cr	1.4-2.7	n,n'+1.44γ	graph	γ scin	54K24
	2.5	n,1.1n'	1.0	n scin	54E8
	0.015-10^4 ev	t	graphs		54M51
Cr^{54}	pile	n,γ	0.36	3.6^{m}Cr	54B57
Mn^{55}	0.1-12 kev	t	graph		54S61
	3-13	t	graph		54N17
Fe	1.0	el(θ)	graph	pc	54W13
	0.8-2.7	n,n'+0.85γ	graph	γ scin	54K24
	2.5	n,1.6n'	1.0	n scin	54E8
	4.3	el	~2.6	ppl	54J6
	4.3	n,3.45n'	~0.9	ppl	54J6
	4.3	n,2.2n'	~0.4	ppl	54J6
	4.3	n,1.6n'	~0.2	ppl	54J6
	19.0	t	2.23		53D28
	95-108	t	table		54C42
	410	t	1.07		54N8
Fe^{54}	pile	n,γ	2.2	2.9^{y}Fe	54R13
	pile	n,p	0.011	320^{d}Mn	53S66
Fe^{58}	pile	n,γ	0.98	45^{d}Fe	54R13
Co^{59}	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
Ni	0.002-0.8 ev	t	graph		54G21
	1.0	el(θ)	graph	pc	54W13
	1.3-2.7	n,n'+1.33γ	graph	γ scin	54K24
	1.3-2.7	n,n'+1.47γ	graph	γ scin	54K24
	2.8	el	0.9	n scin	53P17
	2.8	n,1.4n'	0.6	n scin	53P17
	3-13	t	graph		54N17
Cu	1.0	el(θ)	graph	pc	54W13
	19.0	t	2.56		53D28

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
Cu	48	t	2.81		54H56
	88	t	2.26		54H56
	410	t	1.19		54N8
Zn	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
Ga	$0.05-10^{4}$ ev	t	graph		53M51
Se	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
Br	3-13	t	graph		54N17
	17.2-20.1	t	table		53D28
Br^{79}	pile		~0.01	5.1^{s}Br?	54S37
Sr	1.0	el(θ)	graph	pc	54W13
Zr	0.02-60 ev	t	6.2		54J12
	1.0	el(θ)	graph	pc	54W13
	19	t	3.60		53D28
Nb^{93}	1.0	el(θ)	graph	pc	54W13
	pile	n,n'	~0.0008	3.7^{y}Nb	54S74
Nb^{94}	pile	n,γ	graph	35^{d}Nb	53D18
Mo	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
Ru	$0.01-10^{3}$ ev	t	graph		53M51
Pd	10-50 ev	t	graph		54L12
Ag	th	a	58 2	mean life	54S66
	2.5-800 ev	t	graph		54S61
	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
Cd	0.002-0.6 ev	t	graph		54G21
	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
	3.7	el(θ)	2.5	n scin	54S31
	3.7	t	4.5		54S31
	410	t	1.85		54N8
In	1.0	el(θ)	graph	pc	54W13
	2.5	n,1.6n'	0.4	n scin	54E8
	2.5	n,1.9n'	0.2	n scin	54E8
In^{115}	0.4-1.8	n,n'	graph	4.5^{h}In	54E1
	0.4-5.5	n,n'	graph	4.5^{h}In	54M8
Sn	1.0	el(θ)	graph	pc	54W13

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
Sn	3-13	t	graph		54N17
	3.7	el(θ)	2.5	n scin	54S31
	3.7	t	4.6		54S31
Sn^{116}	~14	n,p	0.0009	13^{s}In	53W48
Sn^{118}	~14	n,p	0.0008	4.5^{m}In	53W48
Sb	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
Te	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
I^{127}	10-800 ev	t	graph		54S61
Cs^{133}	1-9 ev	t	graph		54L12
Ba	0.82	n,n'	~0.005	2.6^{m}Ba	54S40
	1.0	el(θ)	graph	pc	54W13
La	3-13	t	graph		54N17
Ce	1.0	el(θ)	graph	pc	54W13
Nd	0.06-3	t	graph		5402
Sm	0.005-0.18 ev	t	graph		54M6
	0.06-3	t	graph		5402
Eu	0.08-58 ev	t	graph		54S11
Ho^{165}	0.3-50 ev	t	graph		54F19
Er	th	s coh	7.8		53K53
	0.6-3	t	graph		5402
Tm^{169}	0.1-50 ev	t	graph		53F19
Yb	0.06-3	t	graph		5402
Lu	0.03-35 ev	t	graph		53F19
Hf	0.1 ev	t	64.4		54J12
	0.4 ev	t	92.4		54J12
	$1-10^{3}$ ev	t	graph		53B78
	0.06-3	t	graph		5402
	1.0	el(θ)	graph	pc	54W13
Hf^{176}	0.8-16 ev	t	graph		53B78
Hf^{177}	th	a	~350	osc	53B78
	0.8-16 ev	t	graph		53B78
Hf^{178}	th	a	~90	osc	53B78
	0.8-16 ev	t	graph		53B78
Hf^{179}	th	a	~75	osc	53B78
	0.8-16 ev	t	graph		53B78

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
Hf^{180}	0.8-16 ev	t	graph		53B78
Ta^{181}	0.3-50 ev	t	graph		53C45
	5-5000 ev	t	graph		53M51
	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
Ta^{182}	th	n,γ	$>10^4$	5.2^dTa	53D20
	pile	n,γ	$\sim 6\times10^4$	5.2^dTa	54D13
W	1.0	el(θ)	graph	pc	54W13
	2.5	n,~1.5n'	1.3	n scin	53P17
	2.5	n,>2n'	1.6	n scin	53P17
	3-13	t	graph		54N17
Re	$0.003-10^4$ ev	t	graph		53M51
Au^{197}	0.0013-0.036 ev	t	graph		53C35
	0.0253 ev	a	98.7* 6		53C35

*Value from 1/v line plus 1% for 4.9-ev res.

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
	0.3-100 ev	t	graph		54L12
	0.4-0.5	n,n'	graph	7.4^sAu	54M8
	0.53-2.0	n,n'	graph	7.4^sAu	54E1
	1.0	el(θ)	graph	pc	54W13
	2.5	n,~1.5n'	0.9	n scin	53P17
	2.5	n,>2 n'	2.5	n scin	53P17
	3-13	t	graph		54N17
Hg	0.62	n n,n'	$\sim$0.001	44^mHg	54S40
	1.0	el(θ)	graph	pc	54W13
	3-13	t	graph		54N17
Tl	3-13	t	graph		54N17
Pb	1.0	el(θ)	graph	pc	54W13
	1.2-2.7	n,n'+0.81γ	graph	γ scin	54K24
	19	t	5.96		53D28
	48	t	4.5		54H56
	88	t	4.83		54H56
	62-108	t	table		54C42
	410		2.89		54N8
Pb^{206}	1.0	el(θ)	graph	pc	54W13
Pb^{207}	2.2	n,n'	0.040	0.82^sPb	54S54
	3.1	n,n'	0.140	0.82^sPb	54S54
Bi^{209}	0.8-2.7	n,n'+0.90γ	graph	γ scin	54K24
	0.8-2.7	n,n'+1.56γ	graph	γ scin	54K24
	1.0	el(θ)	graph	pc	54W13
	2.4	el	2.9	n scin	53P17
	2.4	n, 1.1 n'	0.3	n scin	53P17

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
Bi^{209}	2.4	n, 1.5 n'	0.8	n scin	53P17
	2.5	n, 0.9 n'	0.6	n scin	54E8
	2.5	n, 1.6 n'	1.2	n scin	54E8
	3.7	el(θ)	6.9	n scin	54S31
	3.7	t	8.3		54S31
	19.0	t	5.69		53D28
	45-131	t	table		54L4
Th^{230}	th	a	26		53P23
Th^{232}	1.0	el(θ)	graph	pc	54W13
	410	t	3.21		54N8
U	0.002-0.8 ev	t	graph		54G21
	0.02-7.6	t	graph		54H17
	17-20	t	6		54H17
	18-20.1	t	table		53D28
	45-131	t	table		54L8
	410	t	3.23		54N8
U^{235}	0.0253 ev	a	691	chopper	54P13
Pu^{239}	th	σ_f/σ_f(U)	206 4		54L20
Pu^{242}	pile	n,γ	$\sim$30		54S5
Pu^{243}	pile	n,γ	$\sim$100		54S5
$16^h Am^{242}$	pile	n,f	2950		54H13
Am^{243}	pile	n,γ	$\sim$115	ms	54S33
	pile	n,γ	$\sim$140	26^mAm	54H40
Cm^{244}	pile	n,γ	$\sim$25	ms	54S33
Cm^{245}	pile	n,γ	$\sim$200	ms	54S33
Cm^{246}	pile	n,γ	$\sim$15	ms	54S33
Bk^{249}	pile	n,γ	$\sim$1100	3.1^hBk	54H40
Cf^{249}	pile	n,γ	270	$\sim 9^y$Cf	54H40
	pile	a	$\sim$900	Cf^{249} loss	54H40
Cf^{252}	pile	n,γ	30	19^d99	54H40
Cf^{254}	pile	n,$\gamma\beta$	<2	$\sim 15^h$100	54H40
99^{253}	pile	n,γ	$\sim$240	37^h99	54F14
	pile	n,γ	160	3.2^h100	54H40
99^{254}	pile	n,γ	<15	$\sim 15^h$100	54H40

53B78 L.M.Bollinger, S.P.Harris, C.T.Hibdon, C.O. Muehlhause, Phys. Rev. 92, 1527 (1953); 87, 222A (1952). Based on σ_a(B) = 755.

53C35 R.S.Carter, H.Palevsky, V.W.Myers, D.J.Hughes, Phys. Rev. 92,716(1953); 91, 450A(1953).

53C45 R.L.Christensen, Phys. Rev. 92, 1509(1953).

53C49 J.H.Coon, quoted by J.D.Seagrave, Phys. Rev. 92, 1222(1953).

Neutron Cross Sections continued

53D18	D.L.Douglas, A.C.Mewherter, R.P.Schuman, Phys. Rev. 92, 369, 1095A (1953).
53D20	J.W.M.DuMond, H.C.Hoyt, P.E.Marmier, J.J.Murray, Phys. Rev. 92, 202 (1953). Based on $\sigma(Ta^{181})$.
53D28	R.B.Day, R.L.Henkel, Phys. Rev. 92,358(1953).
53F19	H.L.Foote, Jr., H.H.Landon, V.L.Sailor, Phys. Rev. 92, 656 (1953).
53G33	J.B.Guernsey, C.Goodman, Phys. Rev. 92, 323 (1953); 91, 404A (1953).
53H35	K.F.Hansen, R.M.Kiehn, C.Goodman, Phys. Rev. 92, 652 (1953).
53K53	W.C.Koehler, E.O.Wollan, Phys. Rev. 92, 1380 (1953).
53K54	C.W.Kimball, G.R.Ringo, T.R.Robillard, S. Wexler, quoted by B.Hamermesh, G.R.Ringo, S.Wexler, Phys. Rev. 90, 603 (1953).
53M51	E.Melkonian, W.W.Havens, Jr., L.J.Rainwater, Phys. Rev. 92, 702 (1953).
53P17	M.J.Poole, Phil. Mag. 44, 1398 (1953); isotropy assumed.
53P21	S.W.Peterson, H.A.Levy, S.H.Simonsen, J.Chem. Phys. 21, 2084 (1953).
53P23	H.Pomerance, ORNL-1620 (1953). Based on σ_a(Au)=95.
53R25	R.Ricamo, Nuovo Cim. 10, 1607 (1953).
53S66	G.H.Stafford, L.H.Stein, Nature 172,1103(1953).
53S69	J.D.Seagrave, Phys. Rev. 92, 1222 (1953).
53S72	W.Selove, K.Strauch, F.Titus, Phys. Rev. 92, 724 (1953).
53T20	A.E.Taylor, Phys. Rev. 92, 1071 (1953).
53W48	Z.Wilhelmi, R.Brunsz, C.Dabrowski, Bull. Acad. Polon, Sci. 1, 105 (1953).
54A28	M.H.Alston, A.V.Crewe, W.H.Evans, L.L.Green, J.C.Willmott, Proc. Phys. Soc. 67A, 657(1954).
54B22	H.E.Banta, R.L.Macklin, Phys. Rev. 94, 807A (1954); Science 119, 350.
54B57	G.A.Bazorgan, J.W.Irvine, Jr., C.D.Coryell, Phys. Rev. 95, 781 (1954). Based on σ_a(Au)=94.
54B65	H.Berthet, J.Rossel, Helv. Phys. Acta 27, 159A (1954). Based on $\sigma_{np}(N^{14})$= 1.75.
54C16	C.F.Cook, T.W.Bonner, Phys. Rev. 94,651(1954).
54C42	V.Culler, R.W.Waniek, Phys. Rev. 95, 585,659A (1954).
54C43	O.Chamberlain, J.W.Easley, Phys. Rev. 94,208 (1954).
54D9	J.D.Dudley, C.M.Class, Phys. Rev. 94, 807A (1954).
54D13	E. der Mateosian, Phys. Rev. 95, 646A(1954); verbal report.
54D21	J. De Pangher, Phys. Rev. 95, 578(1954). Based on σ_t=0.035.
54E1	A.A.Ebel, C.Goodman, Phys. Rev. 93,197(1954).
54E8	E.A.Elliot, D.Hicks, L.E.Beghian, H.Halban, Phys. Rev. 94, 144 (1954).
54F3	G.M.Frye, Jr., Phys. Rev. 93, 1086 (1954).
54F9	R.E.Fields, R.L.Becker, R.K.Adair, Phys. Rev. 94, 389 (1954).
54F14	M.H.Studier, P.R.Fields, H.Diamond, J.F.Mech, A.M.Friedman, P.Sellers, G.Pyle, C.M.Stevens, L.B.Magnusson, J.R.Huizenga, Phys. Rev. 93, 1428 (1954).
54G21	E.Gatti, E.Germagnoli, G.Perona, Nuovo Cim. 11, 262 (1954).
54H13	G.H.Higgins, W.W.T.Crane, Phys. Rev. 94, 735 (1954).
54H17	R.L.Henkel, L.Cranberg, G.A.Jarvis, R.Nobles, J.E.Perry, Jr., Phys. Rev. 94, 141 (1954).
54H37	P.Huber, T.Hürlimann, Helv. Phys. Acta 27, 155A (1954).

Neutron Cross Sections continued

54H40	B.G.Harvey, H.P.Robinson, S.G.Thompson, A.Ghiorso, G.R.Choppin, Phys. Rev. 95, 581 (1954).
54H41	A.J.Hartzler, R.T.Siegel, W.Opitz, Phys. Rev. 95, 185, 591 (1954). Based on σ_t= 0.033.
54H44	G.R.Hennig, Phys. Rev. 95, 92 (1954). Based on $\sigma_{np}(N^{14})$= 1.78.
54H56	P.Hillman, R.H.Stahl, N.F.Ramsey, Phys. Rev. 96, 115 (1954).
54J6	B.Jennings, J.B.Weddell, R.L.Hellens, Phys. Rev. 95, 636A (1954).
54J12	E.G.Joki, J.E.Evans, Phys. Rev. 96, 849A (1954).
54K24	R.M.Kiehn, C.Goodman, Phys. Rev. 95, 989 (1954).
54L3	W.S.Lyon, J.J.Manning, Phys. Rev. 93,501(1954).
54L4	W.I.Linlor, B.Ragent, Phys. Rev. 92, 835(1954); 93, 951A (1954).
54L12	H.H.Landon, V.L.Sailor, Phys. Rev. 93, 1030 (1954).
54L20	A.Lévêque, R.Cohen, E.Cotton, J. phys. radium 15, 101 (1954).
54M2	H.C.Martin, Phys. Rev. 93, 498 (1954).
54M6	A.W.McReynolds, E.Andersen, Phys. Rev. 93,195, (1954).
54M8	H.C.Martin, B.C.Diven, R.F.Taschek, Phys. Rev. 93, 199 (1954); 92, 1096A (1953).
54N8	V.A.Nedzel, Phys. Rev. 94, 174 (1954).
54N17	N.Nereson, S.Darden, Phys. Rev. 94,1678(1954).
54O2	A.Okazaki, S.E.Darden, R.B.Walton, Phys. Rev. 93, 461 (1954).
54P13	H.Palevsky, R.S.Carter, R.M.Eisberg, D.J.Hughes, Phys. Rev. 94, 1088 (1954).
54R13	S.A.Reynolds, G.W.Leddicotte, W.S.Lyon, ORNL-54-1-29(1954). Based on σ_a(Co)=34.
54R15	F.L.Ribe, J.D.Seagrave, Phys. Rev. 94, 934 (1954).
54S5	M.H.Studier, P.R.Fields, P.Sellers, A.M.Friedman, C.M.Stevens, J.F.Mech, H.Diamond, J.Sedlet, J.R.Huizenga, Phys. Rev. 93, 1433 (1954).
54S11	V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 93, 1292 (1954).
54S31	S.C.Snowdon, W.D.Whitehead, Phys. Rev. 94,1267 (1954).
54S33	C.M.Stevens, M.H.Studier, P.R.Fields, J.F.Mech, P.A.Sellers, A.M.Friedman, H.Diamond, J.R. Huizenga, Phys. Rev. 94, 974 (1954).
54S37	G.Scharff-Goldhaber, M.McKeown, Phys. Rev. 95, 613A (1954); and verbal report.
54S40	C.P.Swann, F.R.Metzger, Phys. Rev. 95, 636A (1954).
54S48	J.R.Smith, Phys. Rev. 95, 730(1954). Based on σ_t=1.58 for N
54S54	P.H.Stelson, E.C.Campbell, Phys. Rev. 95, 301A (1954).
54S61	F.G.P.Seidl, D.J.Hughes, H.Palevsky, J.S.Levin, W.Y.Kato, N.G.Sjöstrand, Phys. Rev. 95, 476 (1954).
54S66	F.R.Scott, D.B.Thompson, W.Wright, Phys. Rev. 95, 582 (1954).
54S68	P.Savel, M.E.Nahmias, Compt. rend. 238, 2155 (1954).
54S74	R.P.Schuman, Phys. Rev. 96, 121 (1954).
54S84	C.L.Storrs, D.H.Frisch, Phys. Rev. 95, 1252 (1954).
54T14	L.C.Thompson, J.R.Risser, Phys. Rev. 94, 941 (1954).
54W13	M.Walt, H.H.Barschall, Phys. Rev. 93, 1062 (1954).
54W24	J.B.Weddell, J.H.Roberts, Phys. Rev. 95, 117 (1954); 93, 924A (1954). Based on σ(0.6 Mev)=0.45.

3. GROUND STATE Q'S

For these data it seemed impractical to follow the policy adhered to in the main list of giving the A value of a target nucleus only when enriched material was used or when the target element is known to be monoisotopic. In the following reactions, the A values assigned by the experimenters to target and product nuclei are given as superscripts. In cases where enriched or monoisotopic material was used the superscript is underlined.

The energy standard used, when clearly stated by the authors, is mentioned with the reference. Usually the energy measurement for only one particle, either incident or emitted, presented special difficulties. It is the standard used for this particle that is indicated.

Reaction	Value		Source	Detector	Ref.
$H^{\underline{2}}(\gamma,n)H^{1}$	-2.227	3	EA	BF_3	54N16
$H^{\underline{3}}(He^{3},p)He^{5}$	+11.08		CcW	scin	53M61
$He^{\underline{3}}(d,\gamma)Li^{5}$	+16.3	2	VdG	scin	54H3
$He^{4}(d,p)He^{5}$	-3.3	1	Cyc	ppl	54F22
$He^{5} \longrightarrow He^{4}+n$	+1.00	8	From $H^{3}(He^{3},p)He^{5}$Q		53M61
$He^{5} \longrightarrow He^{4}+n$	+1.09	10	From $Li^{6}(n,d)He^{5}$Q		54F3
$Li^{\underline{6}}(n,d)He^{5}$	-2.57	10	CcW	ppl	54F3
$Li^{7}(p,n)Be^{7}$	-1.6462^{a}	10	VdG	BF_3	54J10
$Li^{7}(p,n)Be^{7}$	-1.6447^{b}	10	VdG	BF_3	54J10
$Be^{8} \longrightarrow 2He^{4}$	+0.0775 value retracted				53A34
$Be^{\underline{9}}(\gamma,n)Be^{8}$	-1.662	3	EA	BF_3	54N16
$B^{\underline{10}}(p,n)C^{10}$	-4.35	20	Cyc	ppl	54A32
$B^{\underline{10}}(d,\alpha)Be^{8}$	+17.829	10	CcW	s	54E10
$B^{\underline{10}}(d,p)B^{11}$	+9.227	5	CcW	s	54E10
$B^{10}(\alpha,d)C^{12}$	+1.39	1		s	53S64
$B^{10}(\alpha,p)C^{13}$	+4.13	2		[illegible]	53S64
$B^{\underline{11}}(d,\alpha)Be^{9}$	+8.029	5	CcW	s	54E10
$B^{11}(d,p)B^{12}$	+1.100			s	54K23
$B^{11}(d,p)B^{12}$	+1.140	[illegible]	VdG	s	53E12
$B^{11}(\alpha,p)C^{14}$	+0.85	2		s	53S64
$C^{12}(d,p)C^{13}$	+2.720	2	CcW	s	54E10
$N^{14}(n,p)C^{14}$	+0.609	5		ic	50I75
$N^{14}(p,n)O^{14}$	-6.0	2	Cyc	ppl	54A11
$N^{14}(\alpha,p)O^{17}$	-1.16		Po α	ppl	53H33
$O^{\underline{18}}(p,\alpha)N^{15}$	+3.961	9	CcW	s	54M60
$O^{\underline{18}}(d,p)O^{19}$	+1.732	8	VdG	s	54T30
$O^{\underline{18}}(d,\alpha)N^{16}$	+4.23	2	VdG	s	54P27
$Ne^{20}(n,\alpha)O^{17}$	-0.70	2		ic	53F30
$Ne^{\underline{20}}(d,\alpha)F^{18}$	+2.791	9	CcW	s	54M61
$Ne^{\underline{20}}(d,p)Ne^{21}$	+4.526	9	CcW	s	54A21
$Ne^{\underline{22}}(d,p)Ne^{23}$	+2.968	8	CcW	s	54A20

Reaction	Value		Source	Detector	Ref.
$Mg^{24}(d,p)Mg^{25}$	+5.02	2		s	53K55
$Mg^{25}(\gamma,p)Na^{24}$	-12.1		βtron	15^{h}Na	54K29
$Mg^{25}(\gamma,n)Mg^{24}$	-7.2		βtron	BF_3	54K29
$Mg^{\underline{25}}(p,\gamma)Al^{26}$	+6.35		Ccw	scin	54K20
$Mg^{26}(\gamma,p)Na^{25}$	-14.3		βtron	62^{s}Na	54K29
$Mg^{26}(\gamma,n)Mg^{25}$	-11.1		βtron	BF_3	54K29
$Mg^{26}(p,n)Al^{26}$g.s?	-5.06	10	Cyc	BF_3	54S63
$Mg^{26}(p,\gamma)Al^{27}$	+8.23	9	CcW	scin	54K9
$Al^{\underline{27}}(\gamma,n)$6.7^{s}Al	-13.4	2	βtron	6.7^{s}Al	54H33
$Al^{\underline{27}}(d,p)Al^{28}$	+5.475			s	54K23
Did not resolve doublet					
$Si^{28}(d,\alpha)Al^{26}$g.s?	+1.416	8	VdG	s	54B60
$Si^{28}(p,n)P^{28}$	-14.9	6	Cyc	0.28^{s}P	54B55
$Si^{29}(\gamma,p)Al^{28}$	-12.3		βtron	2.3^{m}Al	54K29
$Si^{29}(\gamma,n)Si^{28}$	-8.5		βtron	BF_3	54K29
$Si^{\underline{29}}(p,\gamma)P^{30}$	+5.55			scin	54E13
$Si^{30}(\gamma,p)Al^{29}$	-12.9		βtron	6.6^{m}Al	54K29
$Si^{30}(\gamma,n)Si^{29}$	-10.6		βtron	BF_3	54K29
$S^{32}(p,n)Cl^{32}$	-14.1	6	Cyc	0.31^{s}Cl	54B55
$Cl^{35}(\alpha,p)A^{38}$	+0.81	8	Cyc	a	53K31
$A^{40}(\gamma,n)A^{39}$	-9.85	15	βtron	BF_3	54H51
$Ca^{40}(d,p)Ca^{41}$	+6.14	1	VdG	s	54B31
$Ca^{40}(p,n)Sc^{40}$	-15.5	1.0	Cyc	0.2^{s}Sc	54G9
$Ca^{\underline{42}}(d,p)Ca^{43}$	+5.70	2	VdG	s	54B45
$Ca^{\underline{44}}(d,p)Ca^{45}$	+5.19	2	VdG	s	54B45
$V^{\underline{51}}(d,p)V^{52}$	+5.072	8	VdG	s	53S56
$Cr^{\underline{52}}(d,p)Cr^{53}$	+5.70		Cyc	s	53M7
$Ni^{\underline{58}}(d,p)Ni^{59}$	+6.77		Cyc	s	53M7
$Ni^{\underline{58}}(d,p)Ni^{59}$	+6.70	10	VdG	ppl	54P25
$Ni^{60}(p,n)Cu^{60}$	-6.6	4	Cyc	23^{m}Cu	54C15
$Ni^{\underline{60}}(d,p)Ni^{61}$g.s?	+5.55	10	VdG	ppl	54P25

Ground State Q's continued

Reaction	Value		Source	Detector	Ref.
$Cu^{63}(\gamma,2n)Cu^{61}$	-20.0	5	Lin 3^hCu		54B84
$Cu^{63}(\gamma,n)Cu^{62}$	-10.61	5	βtron 10^mCu		54B4
$Cu^{63}(p,n)Zn^{63}$	-4.21				54C12
$Cu^{65}(p,n)Zn^{65}$	-2.12				54C12
$Zn^{\underline{68}}(d,p)Zn^{69}$	+4.16	15		scin	54E2
$As^{\underline{75}}(n,\gamma)As^{76}$	+7.30	4	Pile	s pr	53B76
$Se^{76}(n,\gamma)Se^{77*}$	+7.416	9	Pile	s pr	53K45
$Se^{77}(n,\gamma)Se^{78*}$	+10.483	14	Pile	s pr	53K45
$Kr^{\underline{84}}(d,p)Kr^{85}$	+3.72	5	Cyc	a	53W34
$Kr^{\underline{86}}(d,p)Kr^{87}$	+3.30	5	Cyc	a	53W34
$Sr^{86}(n,\gamma)Sr^{87*}$	+8.433	14	Pile	s pr	53K45
$Sr^{87}(n,\gamma)Sr^{88*}$	+11.07	6	Pile	s pr	53K45
$Zr^{90}(\gamma,n)4.3^mZr$	-12.28		βtron 4.3^mZr		54A15
$Zr^{91}(n,\gamma)Zr^{92*}$	+8.66	4	Pile	s pr	53K45
$Nb^{\underline{93}}(n,\gamma)Nb^{94}$	+7.19	3	Pile	s pr	53B76
$Nb^{\underline{93}}(p,n)Mo^{93}$	-1.27	4	VdG	ppl	54P23
$Mo^{95}(n,\gamma)Mo^{95*}$	+9.15	5	Pile	s pr	53K45
$Rh^{\underline{103}}(p,n)Pd^{103}$ g.s?	-1.53		VdG	ppl	54P23
$Rh^{\underline{103}}(n,\gamma)Rh^{104}$	+6.792	14	Pile	s pr	53B76
$Ag^{107}(n,\gamma)Ag^{108*}$	+7.27	2	Pile	s pr	53B76
$Ag^{109}(\gamma,n)Ag^{108}$	-9.07	7	βtron 2.3^mAg		54B4
$Cd^{113}(n,\gamma)Cd^{114}$	+9.046	8	Pile	s pr	53K45
Mass assignment because of large $\sigma_a(Cd^{113})$					
$Sn^{\underline{124}}(d,p)Sn^{125}$	+3.52	7	Cyc	scin	53W49
$Sb^{121}(n,\gamma)Sb^{122*}$	+6.80	4	Pile	s pr	53B76
$Te^{\underline{124}}(d,p)Te^{125}$	+4.25	7	Cyc	scin	53W49
$Pr^{\underline{141}}(n,\gamma)Pr^{142}$	+5.83	3	Pile	s pr	53B76
$Sm^{149}(n,\gamma)Sm^{150}$	$\geq$7.89	6	Pile	s pr	53K45
Mass assignment because of large $\sigma_a(Sm^{149})$. See Sm^{150}					
$Ta^{\underline{181}}(n,\gamma)Ta^{182}$	+6.07	7	Pile	s pr	53B76
$W^{182}(n,\gamma)W^{183*}$	+6.182	8	Pile	s pr	53K45
$W^{183}(n,\gamma)W^{184*}$	+7.42	2	Pile	s pr	53K45
$Pt^{194}(n,\gamma)Pt^{195*}$	+6.07	4	Pile	s pr	53K45
$Pt^{195}(n,\gamma)Pt^{196*}$	+7.920	12	Pile	s pr	53K45
$Au^{\underline{197}}(n,\gamma)Au^{198}$	$\geq$6.494	8	Pile	s pr	53B76
See Au^{198} in main list.					

Ground State Q's continued

Reaction	Value		Source	Detector	Ref.
$Tl^{203}(n,\gamma)Tl^{204*}$	+6.54	3	Pile	s pr	53B76
$Tl^{205}(n,\gamma)Tl^{206*}$	+6.20	3	Pile	s pr	53B76

*For evidence for mass assignment see item (by same authors) in main list under this nucleus of appropriate element.

50I75 R.Ishiwari, K.Yuasa, Mem. Coll. Sci. Univ. Kyoto, A26, 151 (1950).

53A34 S.K.Allison, Phys. Rev. 91, 882 (1953).

53B76 G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025 (1953). p resonance calibration

53E12 M.M.Elkind, Phys. Rev. 92, 127 (1953). $H\rho(Po\ \alpha) = 331{,}590$ used as standard for both incident and emitted particles.

53H33 E.Hjalmar, H.Slätis, Arkiv Fysik 6, 451; Phys. Rev. 89, 1151 (1953).

53K31 A.Z.Kranz, W.W.Watson, Phys. Rev. 91, 1472(1954).

53K45 B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953). p resonance calibration

53K55 L.M.Khromchenko, Doklady Akad. Nauk SSSR 93, 451 (1953).

53M7 C.E.McFarland, F.B.Shull, Phys. Rev. 89, 892A (1953).

53M61 C.D.Moak, Phys. Rev. 92, 383; 91, 462A (1953). Based on range-energy data of Smith, Phys. Rev. 71, 32 (1947).

53S56 J.E.Schwager, L.A.Cox, Phys. Rev. 92, 102 (1953). $H\rho(Po\ \alpha) = 331{,}590$ used as standard for both incident and emitted particles.

53S64 E.S.Shire, J.R.Wormald, G.Lindsay-Jones, A.Lundén, A.G.Stanley, Phil. Mag. 44,1197(1953).

53W34 G.W.Wheeler, R.B.Schwartz, W.W.Watson, Phys. Rev. 92, 121 (1953).

53W49 N.S.Wall, Phys. Rev. 92, 1526 (1953).

54A11 F.Ajzenberg, W.Franzen, Phys. Rev. 94, 409 (1954); 93, 925A (1954).

54A15 P.Axel, J.D.Fox, Phys. Rev. 95, 613A (1954); verbal report.

54A20 K.Ahnlund, Arkiv Fysik 7, 459 (1954). Based on $Q[C^{12}(d,p)] = 2.722\pm0.005$.

54A21 K.Ahnlund, Arkiv Fysik 7, 155 (1954). Based on $Q[Be^9(d,p)] = 4.587\pm0.006$.

54A32 F.Ajzenberg, W.Franzen, J.G.Likely, Phys. Rev. 95, 1531, 641A(1954).

54B4 M.Birnbaum, Phys. Rev. 93,146(1954); 91,474A (1953). Calibration with Q value masses.

54B31 C.M.Braams, Phys. Rev. 94, 763A (1954). $H\rho = 331{,}590$ used as standard for both incident and emitted particles.

54B45 C.M.Braams, Phys. Rev. 95, 650A(1954). See 54B31

54B55 S.W.Breckon, A.Henrikson, W.M.Martin, J.S.Foster, Can. J. Phys. 32, 223 (1954). Based on $Q[Mg^{24}(p,n)] = -14.8\pm0.3$.

54B60 C.P.Browne, Phys. Rev. 95, 860 (1954). $H\rho = 331{,}590$ used as standard for both incident and emitted particles.

54B84 A.I.Berman, K.L.Brown, Phys. Rev. 96, 83 (1954).

54C12 C.F.Cook, T.W.Bonner, Phys. Rev. 94, 807A(1954).

54C15 B.L.Cohen, E.Newman, R.A.Charple, T.H.Handley, Phys. Rev. 94, 620 (1954).

54E2 F.S.Eby, R.D.Hill, W.K.Jentschke, Phys. Rev. 93, 925A (1954).

54E10 R.B.Elliott, D.J.Livesey, Proc. Roy. Soc. 224A, 129 (1954). p resonance calibration

54E13 P.M.Endt, J.C.Kluyver, C.van der Leun, Phys. Rev. 95, 580 (1954).

Ground State Q's continued

54F3	G.M.Frye, Jr., Phys. Rev. 93, 1086 (1954). Based on $Q[Li^6(n,d)] = 4.780$.
54F22	R.G.Freemantle, T.Grotdal, W.M.Gibson, R.McKeague, D.J.Prowse, J.Rotblat, Phil. Mag. 45, 1090 (1954); erratum 45, Nov. (1954).
54G9	W.W.Glass, J.R.Richardson, Phys. Rev. 93, 942A (1954).
54H3	H.M.Hintz, J.M.Blair, D.M. vanPatter, Phys. Rev. 93, 910, 924A (1954). Compared to γ's of $Li(p,\gamma)$.
54H33	R.N.H.Haslam, W.N.Roberts, D.S.Robb, Can. J. Phys. 32, 361 (1954).
54H51	J.Halpern, R.Nathans, P.F.Yergin, Phys. Rev. 95, 1529 (1954). Calibration from γ,n thresholds of Bi, Mn, C.
54J10	K.W.Jones, R.A.Douglas, M.T.McEllistrem, H.T.Richards, Phys. Rev. 94, 947 (1954). [a] Based on $E_\gamma(Au^{198}) = 411.770 \pm 0.036$ kev. [b] Based on $E_\gamma(Co^{60}) = 1332.5 \pm 0.3$ kev. Measured $E_{thres}[Li^7(p,n)Be^7]/Q[Mg^{24}(p,p')] = 1.3734 \pm 0.0007$.

Ground State Q's continued

54K9	J.C.Kluyver, G.Verploegh, Physica 20, 178 (1954).
54K20	J.C.Kluyver, C. van der Leun, P.M.Endt, Phys. Rev. 94, 1795 (1954).
54K23	L.M.Khromchenko, Doklady Akad. Nauk SSSR 94, 1037 (1954).
54K29	L.Katz, R.N.H.Haslam, J.Goldemberg, J.G.V.Taylor, Can. J. Phys. 32, 580 (1954).
54M60	C.Mileikowsky, Arkiv Fysik 7, 89 (1954). Based on $Q[N^{15}(p,a)] = 4.961 \pm 0.006$.
54M61	C.Mikelkowsky, Arkiv Fysik 7, 117 (1954). Based on $Q[O^{16}(d,p)] = 1.917 \pm 0.005$ presumably.
54N16	J.C.Noyes, J.E.Van Hoomissen, W.C.Miller, B.Waldman, Phys. Rev. 95, 396 (1954). Absolute.
54P23	R.Patterson, Phys. Rev. 95, 303A (1954).
54P25	W.W.Pratt, Phys. Rev. 95, 1517 (1954).
54P27	R.Pauli, Arkiv Fysik 8, 16A (1954).
54S63	H.Schneider, M.Martin, M.Sempert, A.Sutter, Helv. Phys. Acta 27, 172A (1954).
54T30	J.Thirion, R.Cohen, W.Whaling, Phys. Rev. 96, 850A (1954).

4. MASS DIFFERENCES AND RATIOS

Where no superscripts have been used with H, C, and O, the weights of the most abundant isotopes, namely 1, 12 and 16 respectively, are to be understood.

Differences are given in millimass units

	Value		Ref.
$H_2 - H^2$	+1.5473	7	54M37
$H^2_2 - He$	+25.6060	47	54M37
$H^2_2 - HeH$	+25.6074	26	54M37
$2H^2_3 - C$	+84.6508	102	54M37
$2He_2 - O$	+15.5086	88	54M37
$2HeH^2 - C$	+33.4282	68	54M37
$CH_4 - O$	+36.4086	38	54M37
	+36.399	28	53E15
$N^{14} - CH_2$	-12.5999	36	54M37
	-12.591	13	53E15
$1/2(2N^{14} - C_2H_4)$	-12.589	21	53E15
$NH_3 - OH$	+23.750	8	54M37
$\frac{Si^{30} - Si^{29}}{Si^{30} - Si^{28}}$	0.49934	3	53W39
Cl^{35}/Cl^{37}	0.945978	3	53H51
$A^{40} - C_3H_4$	-69.052	44	53E15
$3Ti^{47} - Pr^{141}$	-50.9	3	53H58
$3Ti^{48} - Nd^{144}$	-66.7	3	53H58
$3Ti^{50} - Nd^{150}$	-85.2	5	53H58

	Values		Ref.
$3Cr^{52} - Gd^{156}$	-100.4	4	53H58
$3Mn^{55} - Ho^{165}$	-84.8	8	54H4
$3Fe^{56} - Er^{168}$	-126.0	3	54H4
$Ga^{69} - C_5H_9$	-144.75	4	53C20
$3Ga^{69} - Pb^{207}$	-196.6	6	53H58
$Ga^{71} - C_5H_{11}$	-161.30	8	54C20
$Ge^{70} - C_5H_{10}$	-154.30	6	54C20
$2Ge^{70} - Ce^{140}$	-56.8	6	53H58
$Ge^{72} - C_5H_{12}$	-172.35	5	54C20
$2Ge^{72} - Nd^{144}$	-66.3	2	53H58
$2Ge^{72} - Sm^{144}$	-66.9	8	54H4
$Ge^{73} - C_6H$	-84.51	3	54C20
$2Ge^{73} - Nd^{146}$	-65.8	4	54H4
$Ge^{74} - C_6H_2$	-94.68	6	54C20
$2Ge^{74} - Nd^{148}$	-74.8	2	54H4
$2Ge^{74} - Sm^{148}$	-71.9	4	54H4
$Ge^{76} - C_6H_4$	-110.05	4	54C20
$2Ge^{76} - Sm^{152}$	-76.2	2	53H58
$As^{75} - C_6H_3$	-101.79	4	54C20
$2As^{75} - Nd^{150}$	-77.4	4	54H4
$2As^{75} - Sm^{150}$	-72.5	8	54H4
$Se^{74} - C_6H_2$	-93.14	7	54C20
$2Se^{74} - Nd^{148}$	-72.3	4	54H4

Mass Differences and Ratios continued

	Value		Ref.
$2Se^{74} - Sm^{148}$	-70.0	5	54H4
$Se^{76} - C_6H_4$	-112.06	4	54C20
$2Se^{76} - Sm^{152}$	-81.4	6	53H58
$2Se^{77} - Sm^{154}$	-81.8	3	54H4
$2Se^{77} - Gd^{154}$	-81.0	2	54H4
$2Se^{78} - Gd^{156}$	-87.5	2	53H58
$\frac{Se^{79} - Se^{78}}{Se^{80} - Se^{78}}$	0.50081	10	53H50
$HSe^{80} - C_6H_9$	-146.17	4	54C20
$2Se^{80} - Gd^{160}$	-94.3	2	54H4
$2Se^{80} - Dy^{160}$	-91.0	8	54H4
$H_2Se^{82} - C_6H_{12}$	-161.66	4	54C20
$2Se^{82} - Dy^{164}$	-95.2	8	54H4
$2Se^{82} - Er^{164}$	-96.5	4	54H4
$Br^{79} - C_6H_7$	-136.42	5	54C20
$2Br^{79} - Gd^{158}$	-86.6	2	54H4
Br^{79}/Br^{81}	0.975307	5	53H51
$Br^{81} - C_6H_9$	-154.05	5	54C20
$2Br^{81} - Dy^{162}$	-92.9	5	54H4
$Kr^{78} - 2C_3H_3$	-126.80	8	54C20
$Kr^{82} - 2C_3H_5$	-164.84	6	54C20
$Kr^{83} - C_6H_{11}$	-172.07	5	54C20
$Kr^{84} - 2C_3H_6$	-182.44	5	54C20
$Kr^{86} - 2C_3H_7$	-198.81	6	54C20
$Rb^{85} - C_6H_{13}$	-189.75	6	54C20
$2Rb^{85} - Er^{170}$	-111.7	8	54H4
$Rb^{87} - C_5H_{11}O$	-171.73	17	54C20
$Sr^{84} - C_6H_{12}$	-180.70	15	54C20
$Sr^{86} - C_6H_{14}$	-200.25	10	54C20
$Sr^{87} - C_5H_{11}O$	-172.05	6	54C20
$Sr^{88} - C_4H_8O_2$	-146.46	11	54C20
$2Sr^{88} - Hf^{176}$	-128.7	6	54H4
$2Y^{89} - Hf^{178}$	-131.6	6	54H4
$2Zr^{90} - Hf^{180}$	-137.1	3	54H4
$2Zr^{91} - W^{182}$	-135.5	3	54H4
$2Mo^{95} - Os^{190}$	-146.0	4	54H4
$3Ba^{138} - 2Pb^{207}$	-233.8	8	54H4
$Ce^{140} - 2Ge^{70}$	+56.8	6	53H58
$Pr^{141} - 3Ti^{47}$	+50.9	3	53H58
$Nd^{144} - 3Ti^{48}$	+66.7	3	53H58
$Nd^{144} - 2Ge^{72}$	+66.3	2	53H58
$Nd^{146} - 2Ge^{73}$	+65.8	4	54H4

Mass Differences and Ratios continued

	Values		Ref.
$Nd^{148} - 2Ge^{74}$	+74.8	2	54H4
$Nd^{148} - 2Se^{74}$	+72.3	4	54H4
$Nd^{150} - 3Ti^{50}$	+85.2	5	53H58
$Nd^{150} - 2As^{75}$	+77.4	4	54H4
$Sm^{144} - 2Ge^{72}$	+66.9	8	54H4
$Sm^{148} - 2Ge^{74}$	+71.9	4	54H4
$Sm^{148} - 2Se^{74}$	+70.0	5	54H4
$Sm^{150} - 2As^{75}$	+72.5	8	54H4
$Sm^{152} - 2Ge^{76}$	+76.2	2	53H58
$Sm^{152} - 2Se^{76}$	+81.4	6	54H4
$Sm^{154} - 2Se^{77}$	+81.8	3	54H4
$Gd^{154} - 2Se^{77}$	+81.0	2	54H4.
$Gd^{156} - 3Cr^{52}$	+100.4	4	53H58
$Gd^{156} - 2Se^{78}$	+87.5	2	53H58
$Gd^{158} - 2Br^{79}$	+86.6	2	54H4
$Gd^{160} - 2Se^{80}$	+94.3	2	54H4
$Dy^{160} - 2Se^{80}$	+91.0	8	54H4
$Dy^{162} - 2Br^{81}$	+92.9	5	54H4
$Dy^{164} - 2Se^{82}$	+95.2	8	54H4
$Ho^{165} - 3Mn^{55}$	+84.8	8	54H4
$Er^{164} - 2Se^{82}$	+96.5	4	54H4
$Er^{168} - 3Fe^{56}$	+126.0	3	54H4
$Er^{170} - 2Rb^{85}$	+111.7	8	54H4
$Hf^{176} - 2Sr^{88}$	+128.7	6	54H4
$Hf^{178} - 2Y^{89}$	+131.6	6	54H4
$Hf^{180} - 2Zr^{90}$	+137.1	3	54H4
$W^{182} - 2Zr^{91}$	+135.5	3	54H4
$Os^{190} - 2Mo^{95}$	+146.0	4	54H4
$Pb^{207} - 3Ga^{69}$	+196.6	6	53H58
$2Pb^{207} - 3Ba^{138}$	+233.8	8	54H4

53E15 A.Engler, H.Hintenberger, Helv. Phys. Acta 26, 657 (1953).

53H50 W.A.Hardy, G.Silvey, C.H.Townes, B.F.Burke, M.W.P.Standberg, G.W.Parker, V.W.Cohen, Phys. Rev. 92, 1532 (1953); 85, 494 (1952).

53H51 A.Honig, M.L.Stitch, M.Mandel, Phys. Rev. 92, 901 (1953).

53H58 B.J.Hogg, H.E.Duckworth, Can. J. Phys. 31, 942 (1953).

53W39 R.L.White, C.H.Townes, Phys. Rev. 92,1256(1953).

54C20 T.L.Collins, W.H.Johnson, Jr., A.O.Nier, Phys. Rev. 94, 398 (1954).

54H4 B.J.Hogg, H.E.Duckworth, Can. J. Phys. 32, 65 (1954).

54M37 J.Mattauch, R.Bieri, Z.Naturforsch 9A, 303 (1954). In addition to the measured values listed above, the paper gives values adjusted for self-consistency.